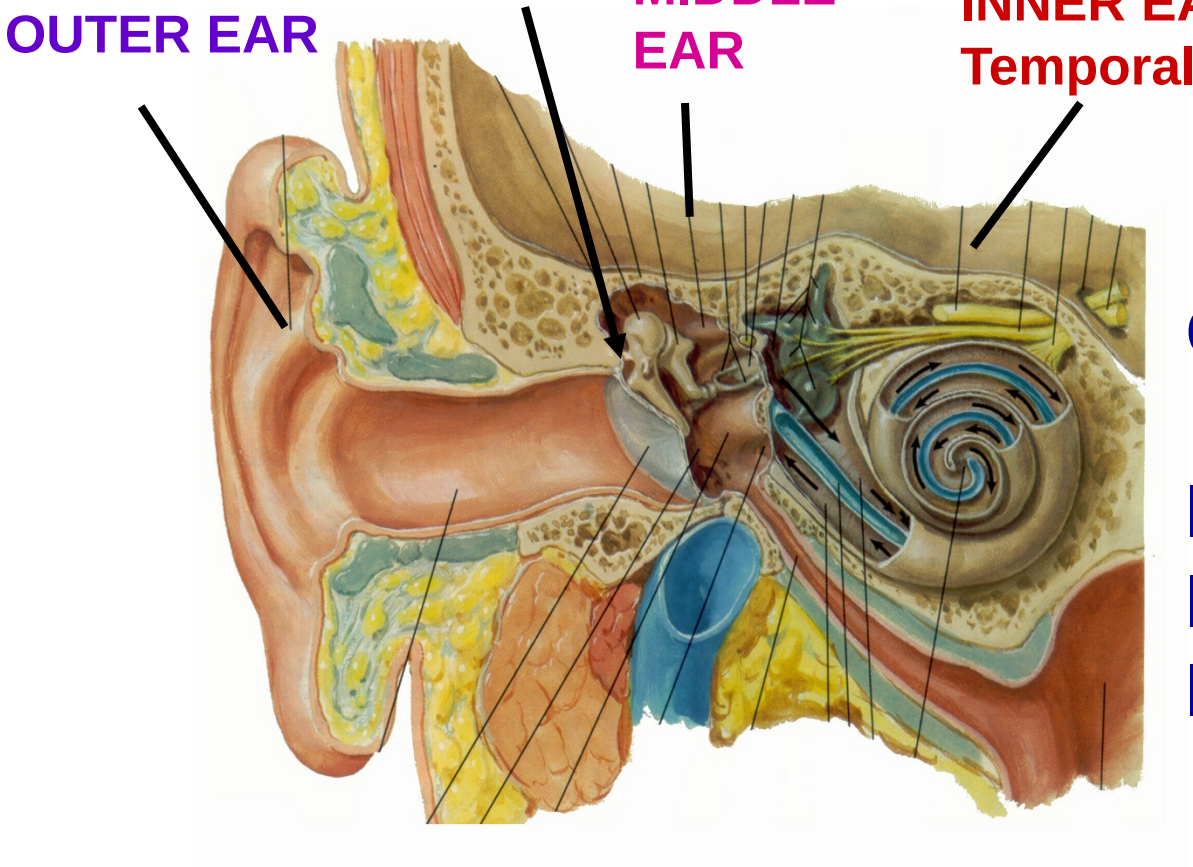
EAR



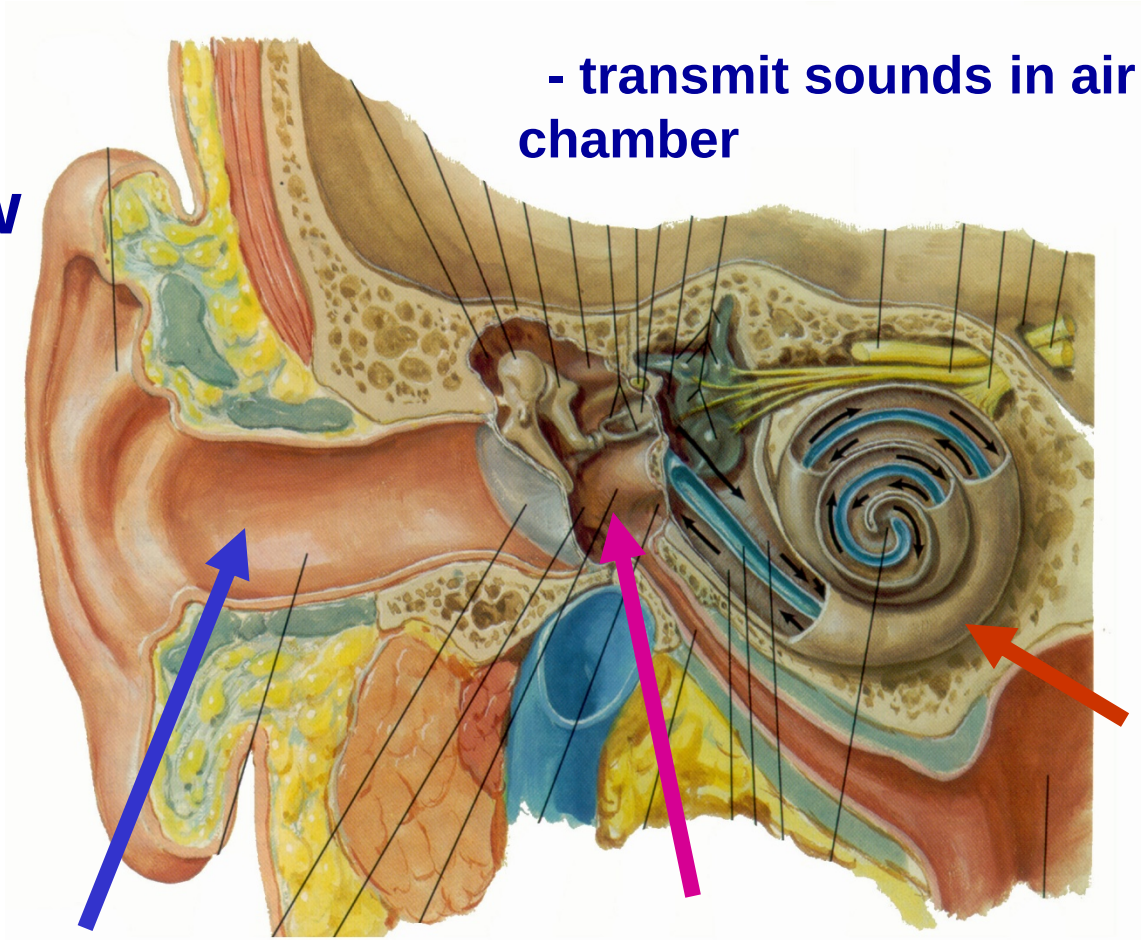
OUTLINE

I. OVERVIEW
II. OUTER EAR
III. MIDDLE EAR

Outer and middle ear transmit sound to inner ear.
Middle ear is dead end space filled with air and connected to nasopharynx; Middle ear infections common (otitis media)

I. EAR - overview

- transmit sounds in air to fluid filled chamber



REGIONS

A. Outer Ear
1) funnel shaped cartilage and skin
2) directs sound (pressure waves in air) to tympanic membrane

B. Middle Ear - air-filled chamber
1) bones link tympanic membrane to cochlea; amplify force/area
2) muscles can dampen loud sounds

C. Inner Ear- fluid-filled chamber inside BONE
1) cochlea- hearing;
2) vestibular apparatus- gravity

CONDUCT SOUND

(CONDUCTIVE HEARING LOSS)

DETECT SOUND

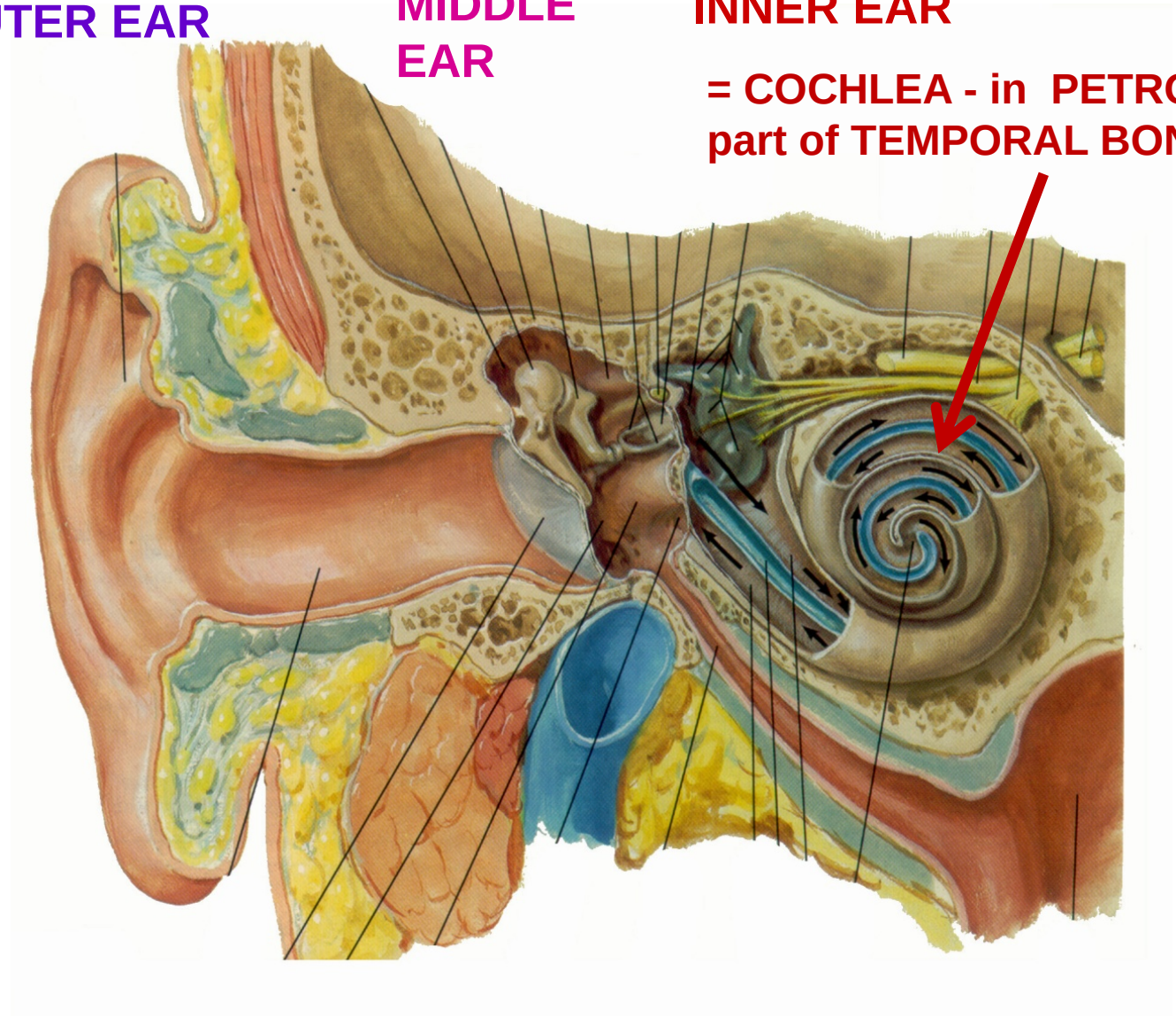
(= SENSORINEURAL PART)

OUTER EAR

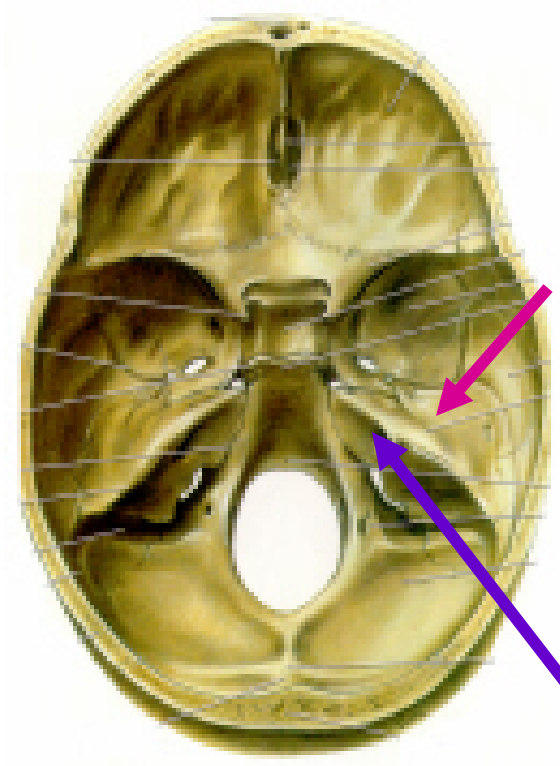
MIDDLE EAR

INNER EAR

= COCHLEA - in PETROUS part of TEMPORAL BONE

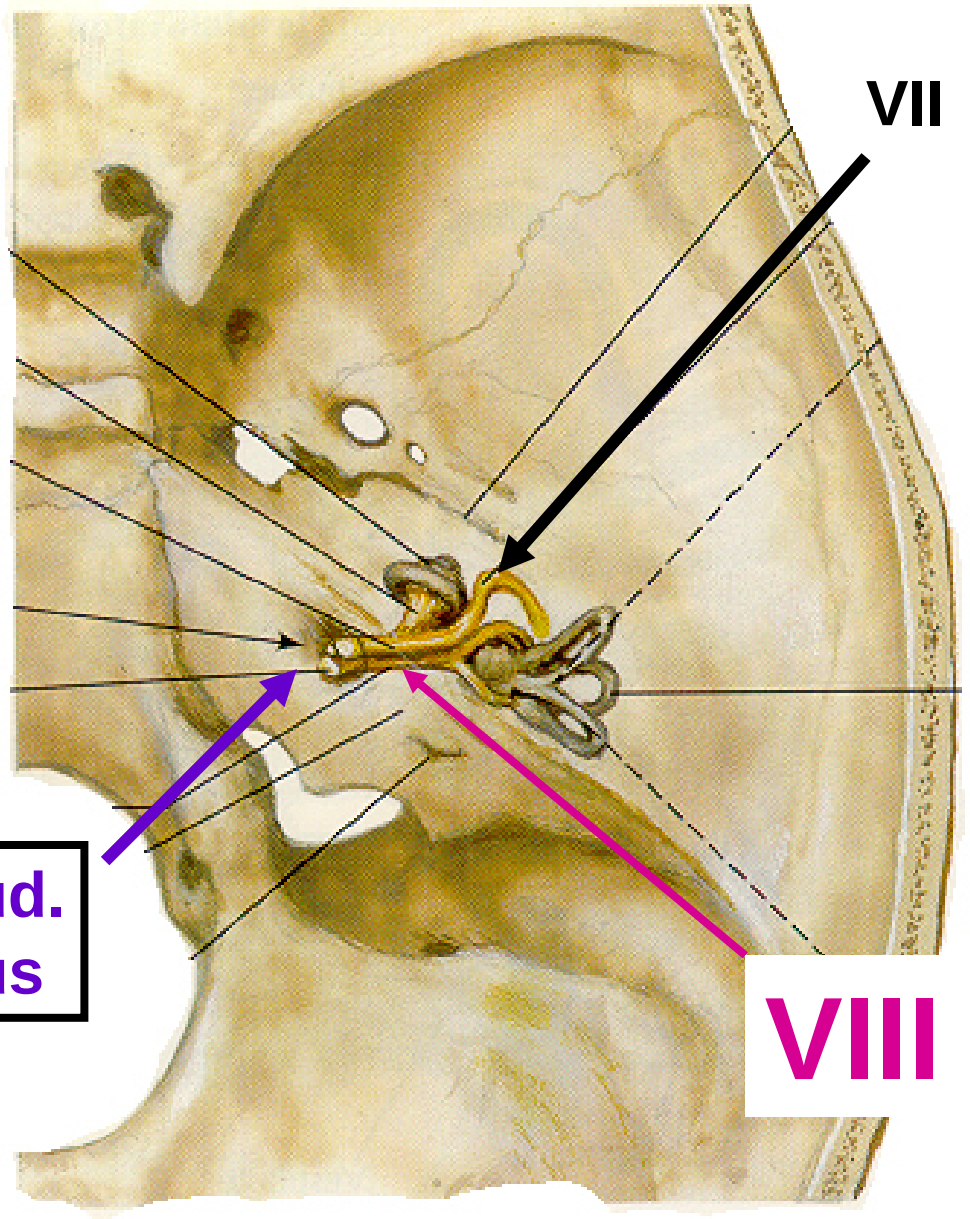


ORIENT: LOCATION OF INNER EAR



Petrous part of temporal bone

Int. aud. meatus



CLINICAL TEST: INNER EAR DETECTS TRANSMITTED VIBRATIONS

Weber test – tuning fork on calvarium directly causes bone to vibrate; conducted to cochlea by bone; perceived as sound by patient

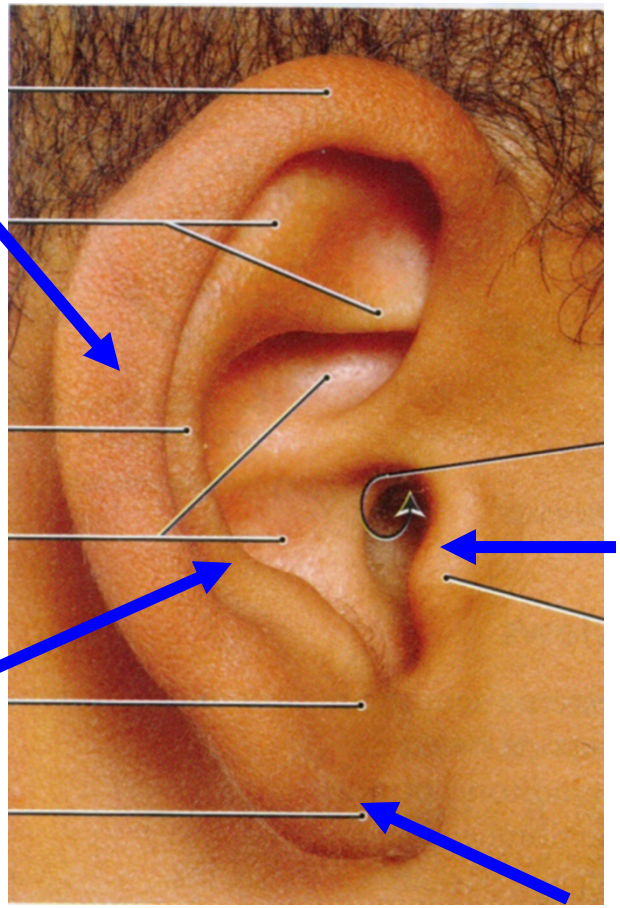
Can use to test functioning of inner ear (Sensorineural hearing loss) independent of outer, middle ear (Conductive hearing loss)

**

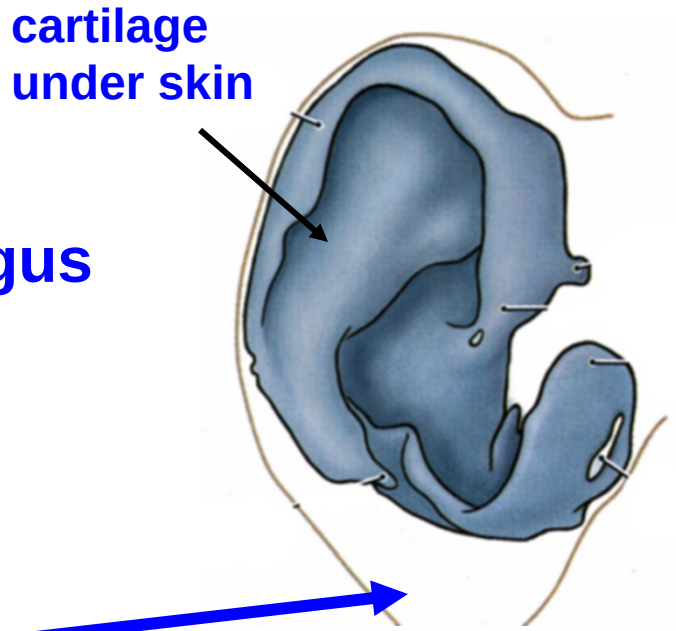
CONDUCTIVE HEARING LOSS - damage to middle ear (tympanic membrane, auditory ossicles (bones)
SENSORINEURAL HEARING LOSS - damage to inner ear (cochlea).

FIGURE 11-18
Weber test. Place the base of the tuning fork on the midline of the skull.

II. OUTER EAR - composed of two parts

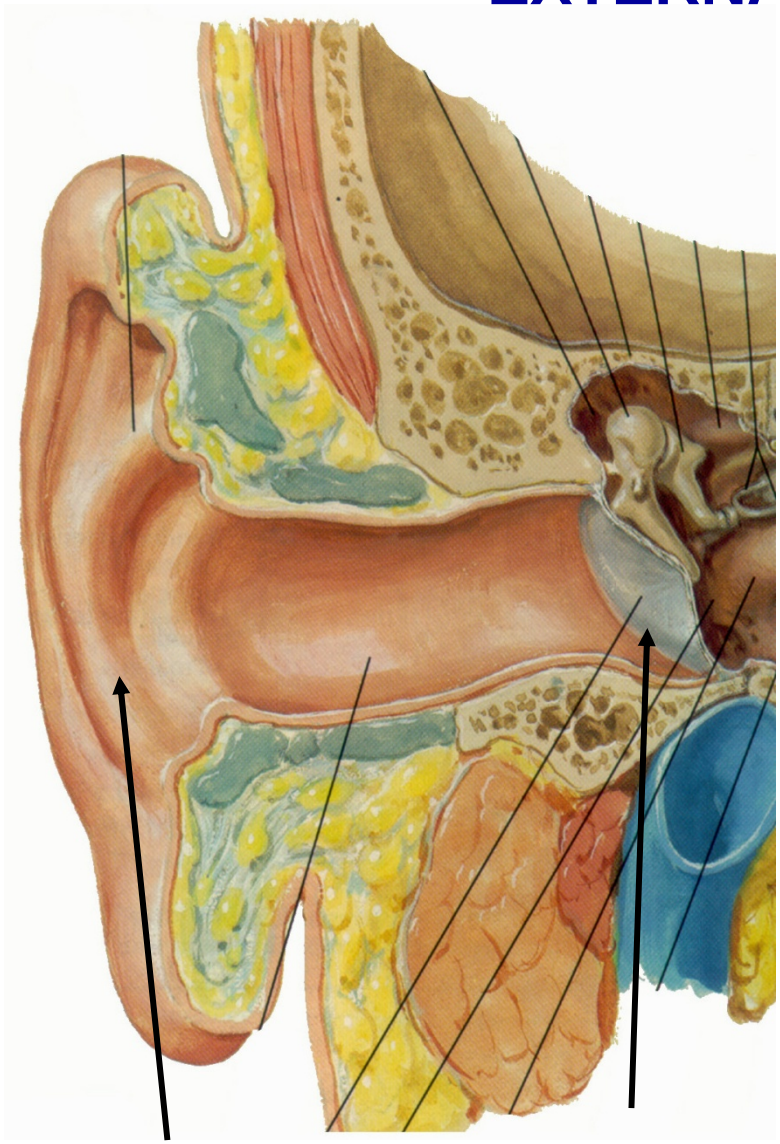


A. AURICLE (pinna) - elastic cartilage and skin - Reflects sound waves



Cartilage does not extend into lobule - Can safely pierce and suspend decorative metal objects from lobule

EXTERNAL AUDITORY MEATUS - location



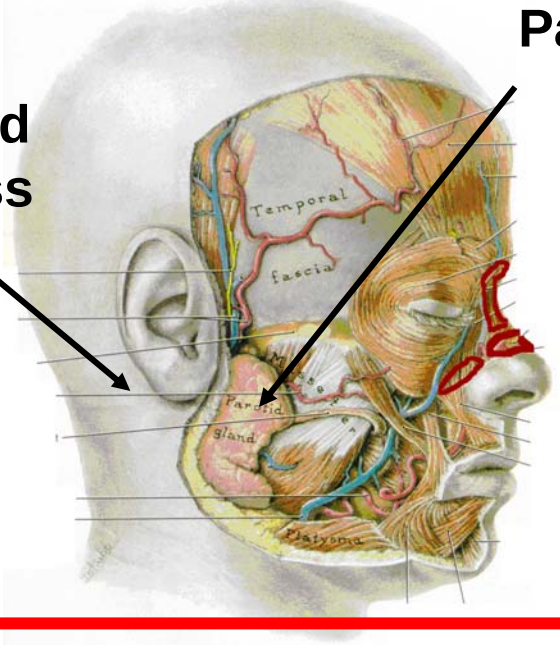
AURICLE

TYMPANIC MEMBRANE

- Tube from auricle to the tympanic membrane; posterior to Parotid gland and TMJ; anterior to mastoid process

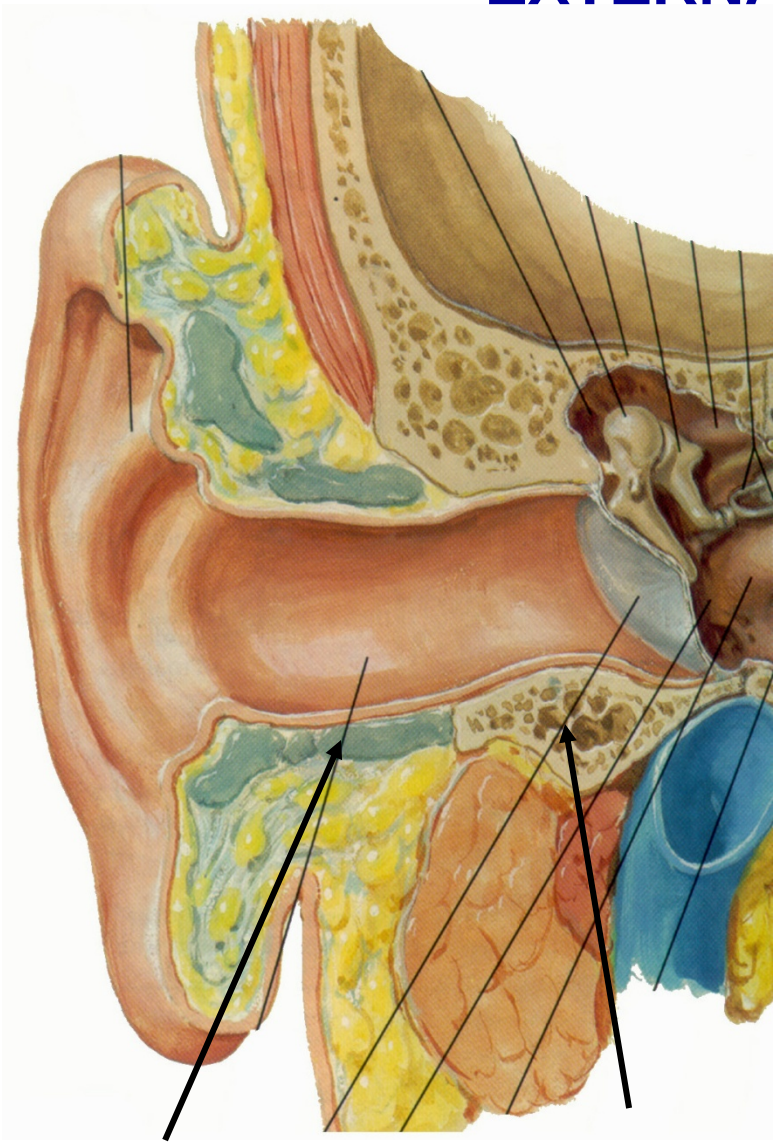
Parotid

Mastoid process



Clinical note - sensory innervation of Outer Ear from CN V, VII, IX and X; patient's with Bell's palsy can have sensation of ear ache. **

EXTERNAL AUDITORY MEATUS



OUTER 1/3
CARTILAGE

INNER 2/3
BONE

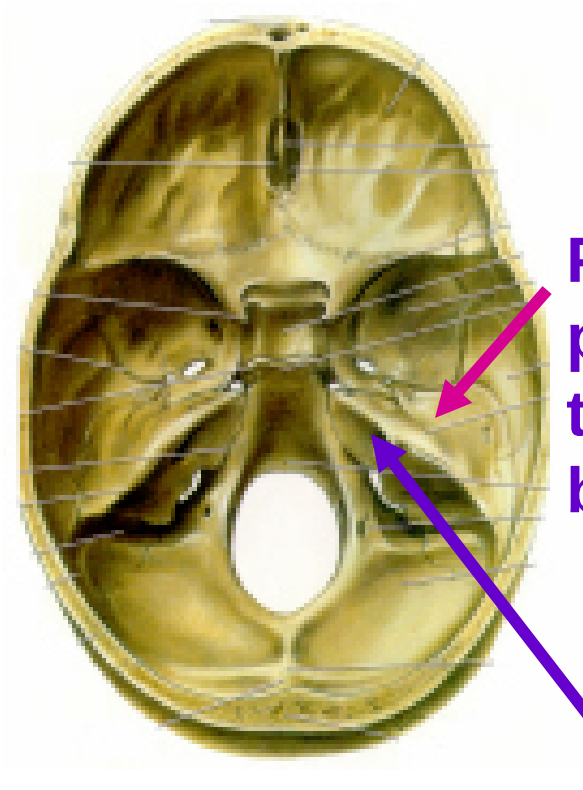
Outer 1/3 - Cartilage - contains hair, sebaceous and ceruminous glands (ear wax [insect repellent]); protects tymp. membrane,

Inner 2/3 - Bone covered by skin

Clinical note: ext. auditory meatus is straight in children, curved anteriorly in adults

In Adult - pull up and back to insert otoscope

III. MIDDLE EAR - hard to visualize

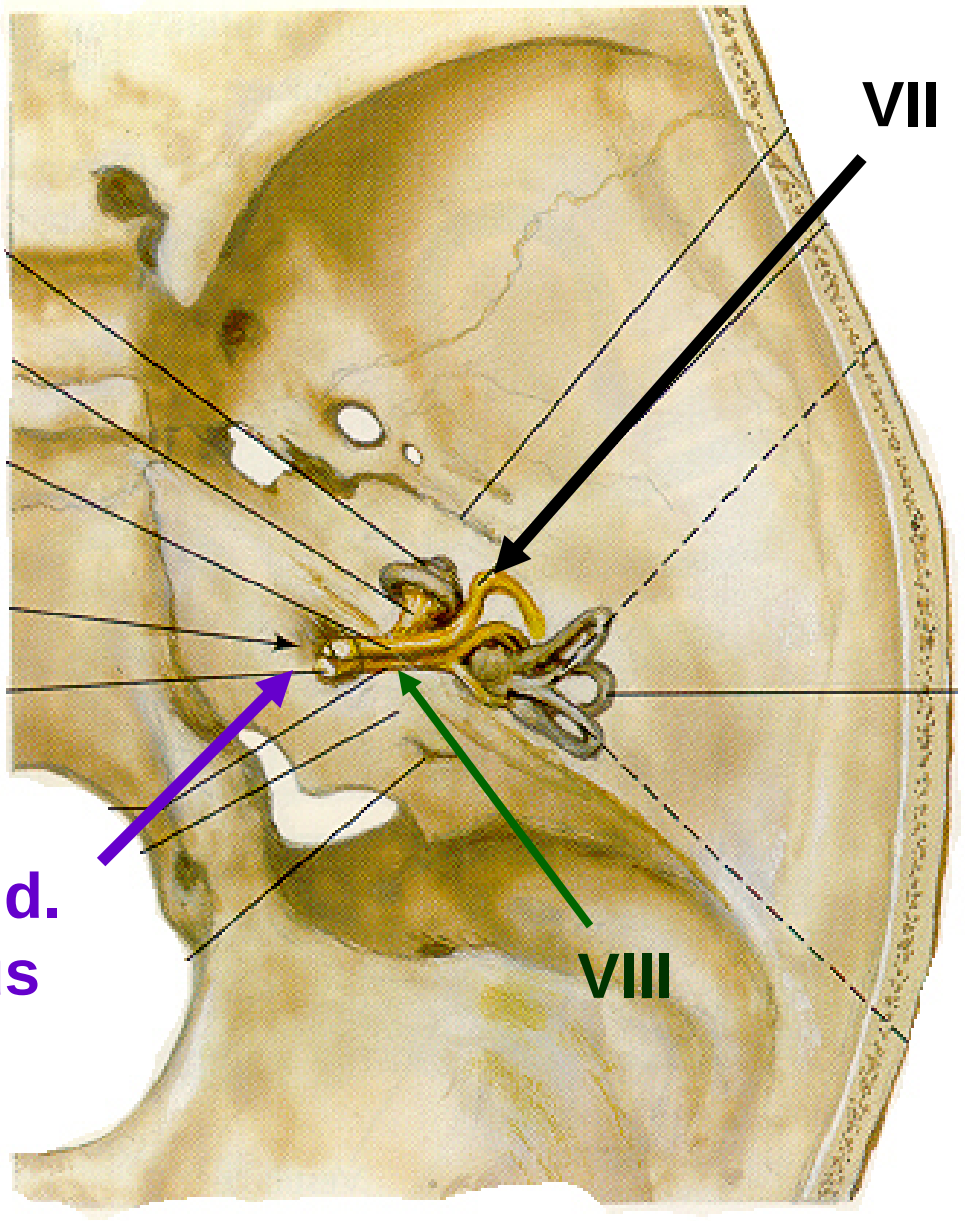


Petrous part of temporal bone

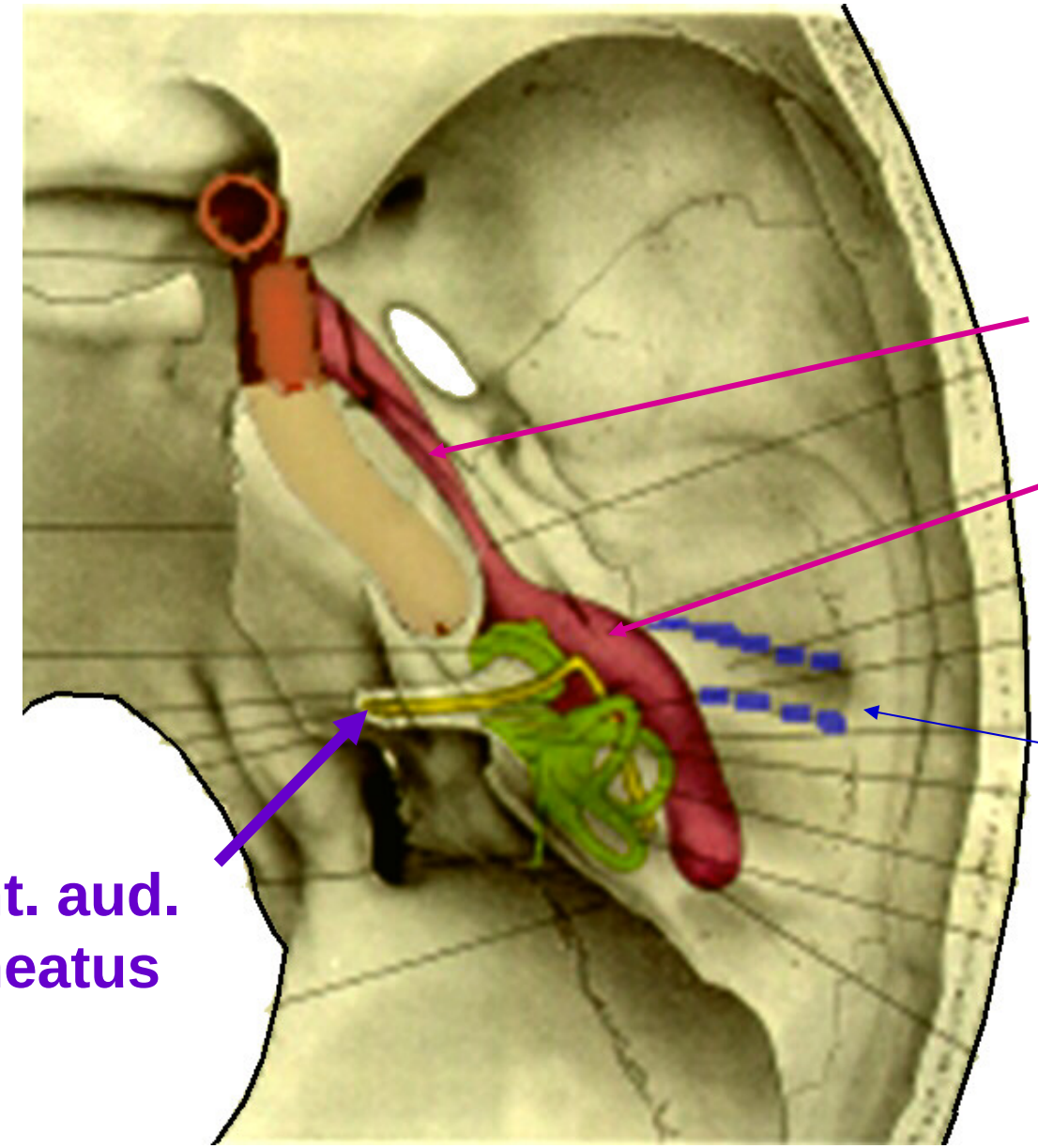
Int. aud. meatus

LOCATION OF MIDDLE EAR AND INNER EAR DIFFICULT TO DEMONSTRATE

ORIENT: LOCATION OF INNER EAR



ORIENT: LOCATION OF MIDDLE EAR



AUDITORY TUBE

MIDDLE EAR - oriented at an angle

External Auditory Meatus

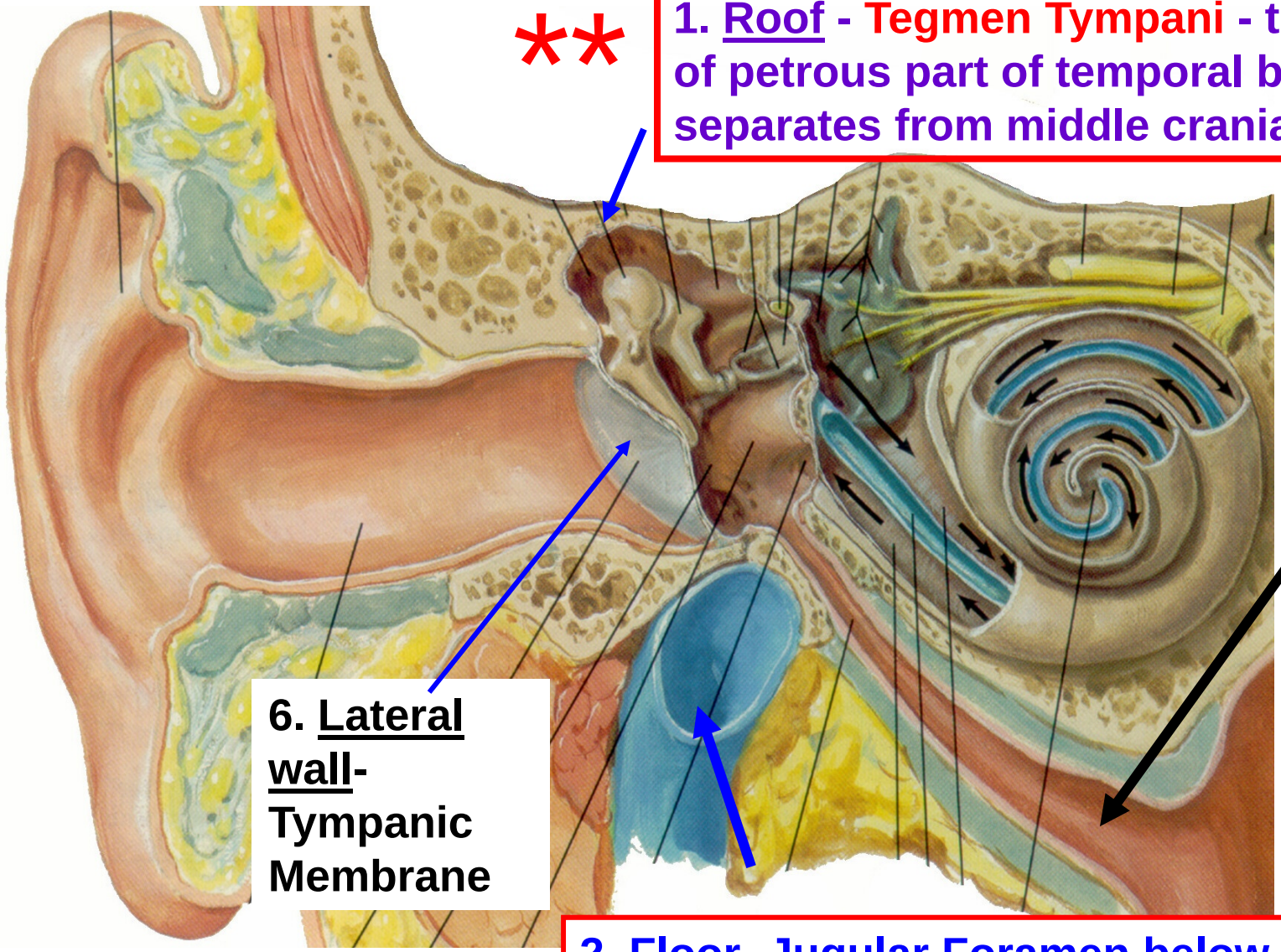
Int. aud. meatus

Meatus = passage, L.

III. MIDDLE EAR - BOUNDARIES

**

1. Roof - Tegmen Tympani - thin plate of petrous part of temporal bone; separates from middle cranial fossa



3. Ant. wall -

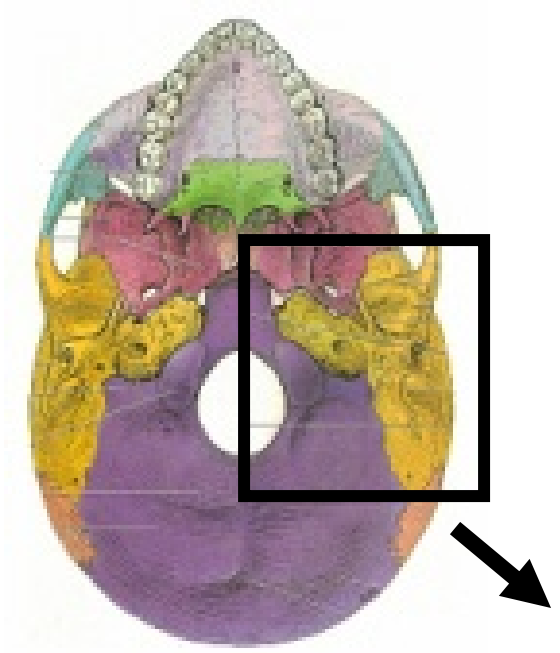
Opening of Auditory Tube (ant. 2/3 cartilage; post. 1/3 bone

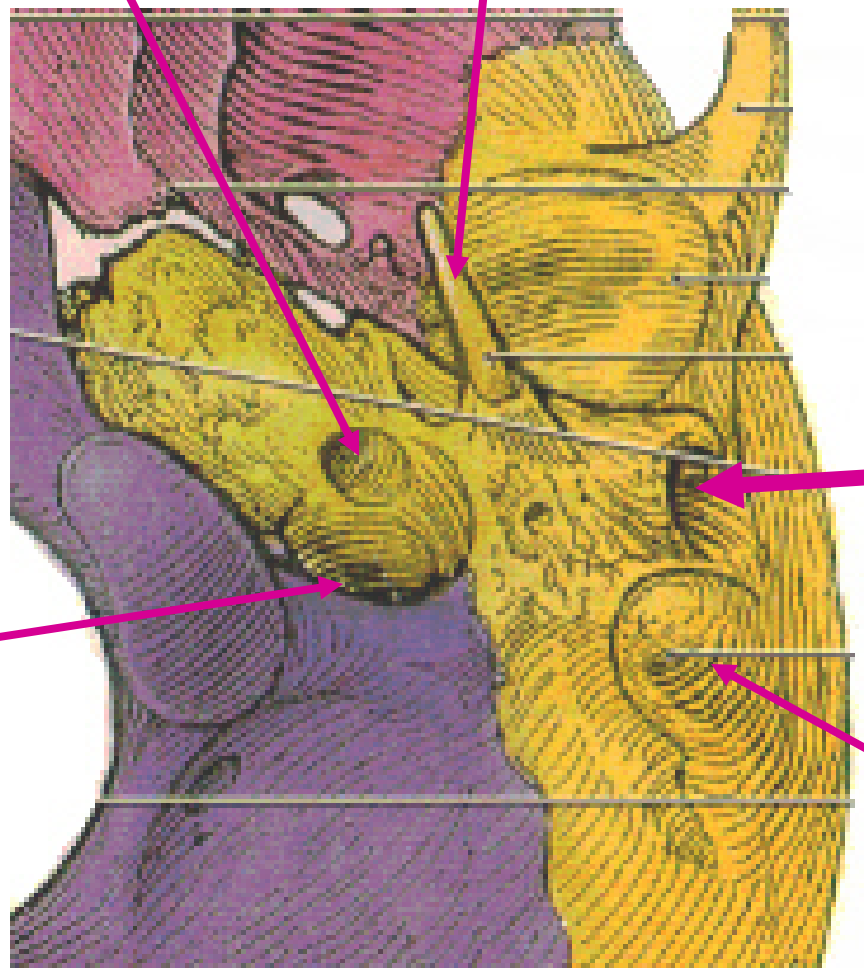
6. Lateral wall- Tympanic Membrane

2. Floor- Jugular Foramen below- Internal Jugular vein can rupture to middle ear

Tegmen = L. roof

ORIENT: LOCATION OF MIDDLE EAR ON SKULL





CAROTID CANAL

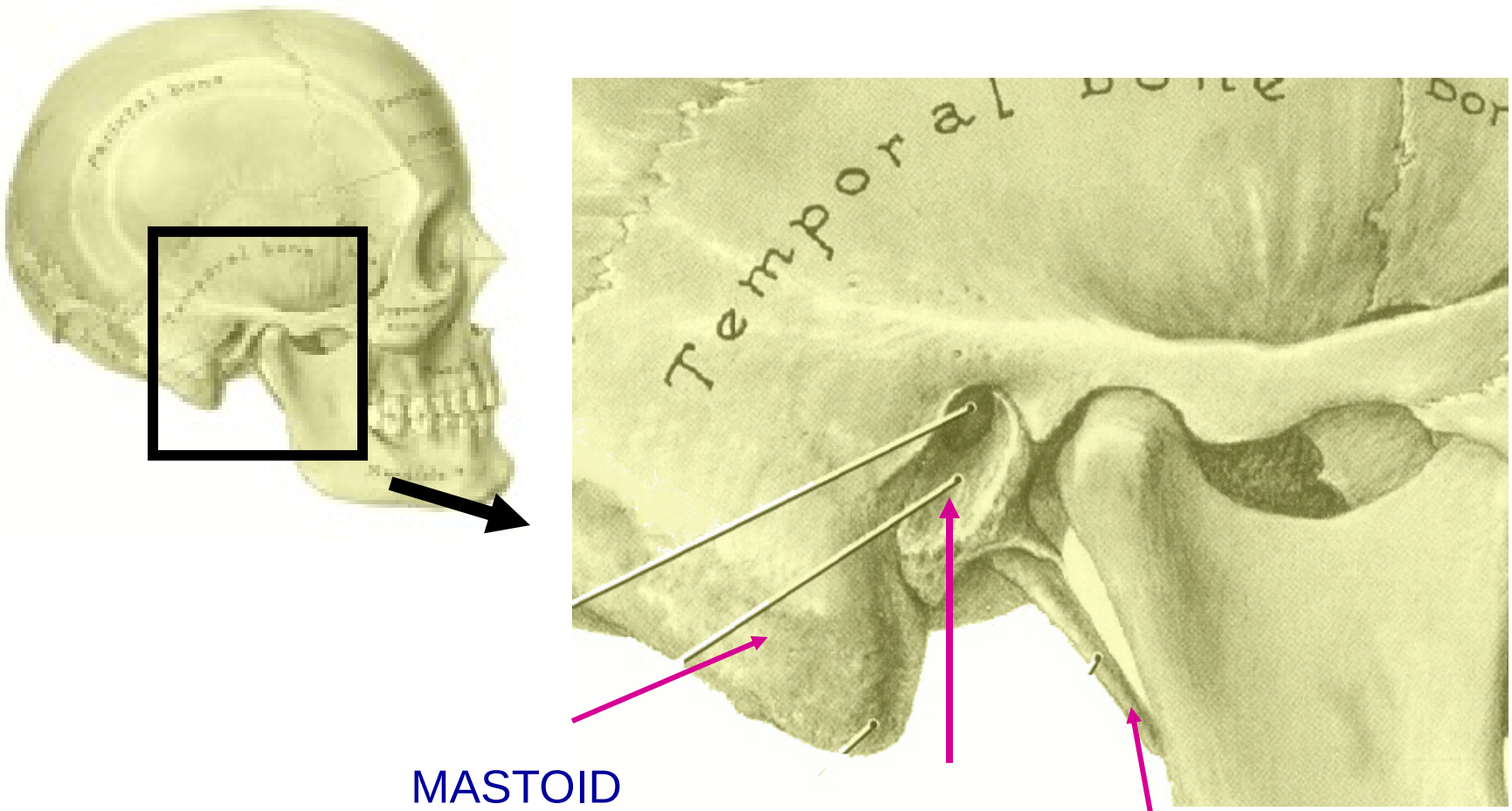
STYLOID PROCESS

EXT AUD. MEATUS

JUGULAR FORAMEN

MASTOID PROCESS

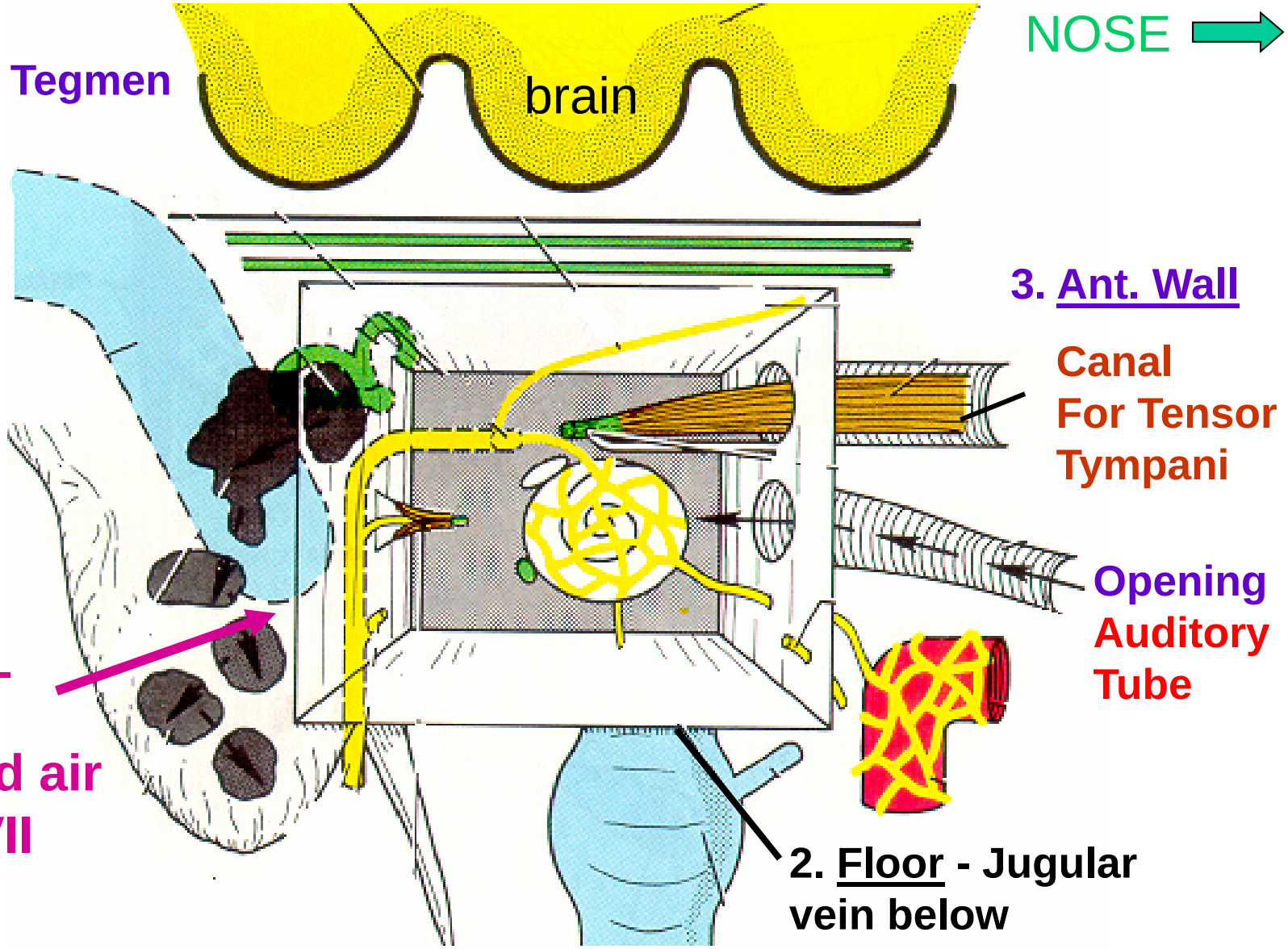
ORIENT: LOCATION OF MIDDLE EAR ON SKULL



MIDDLE EAR: BOUNDARIES

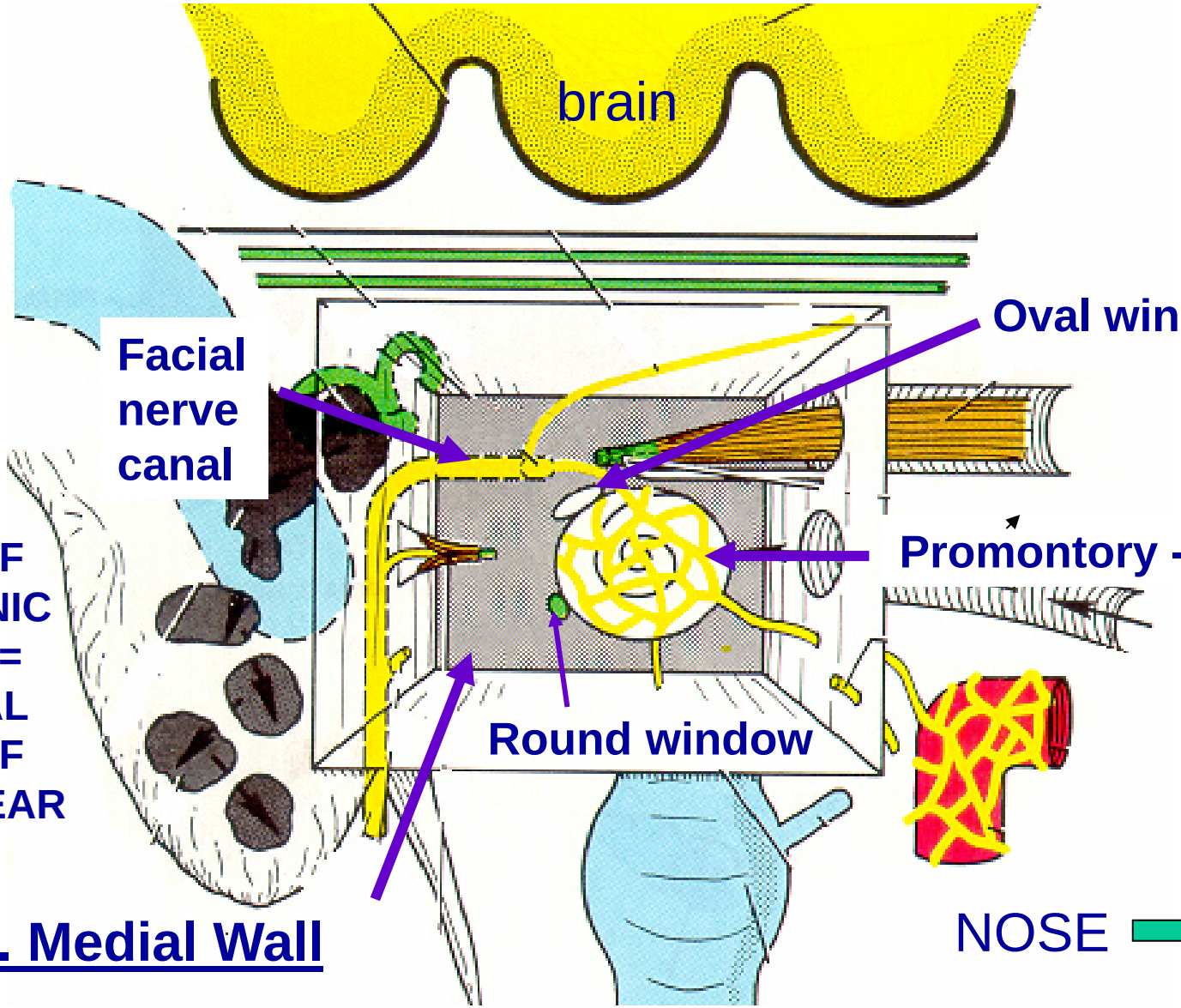
**

1. Roof - Tegmen Tympani



View of Medial Wall of Right Middle Ear with Tympanic membrane and Ossicles Removed (note: Promontory = bulge in wall from Cochlea)

MIDDLE EAR: BOUNDARIES



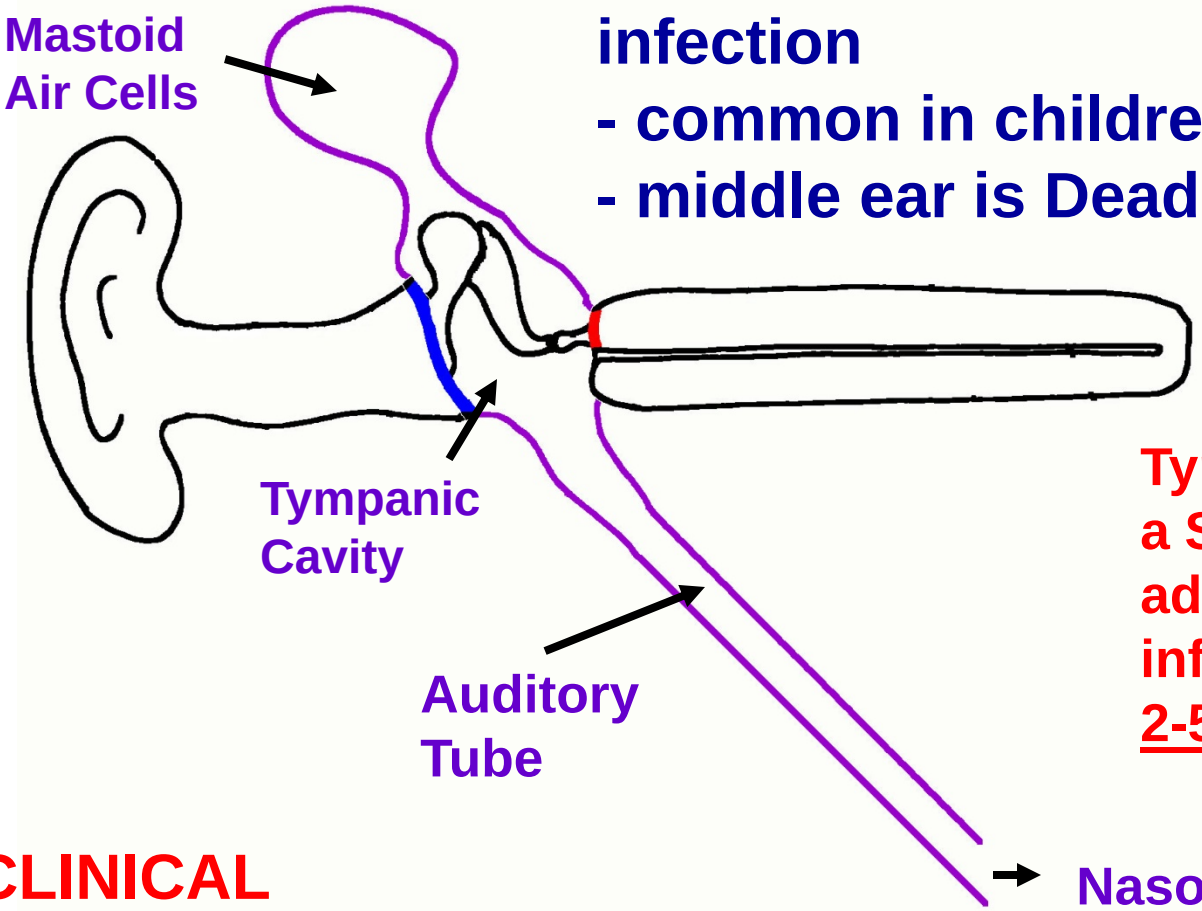
MEDIAL WALL OF TYMPANIC CAVITY = LATERAL WALL OF INNER EAR

5. Medial Wall

Oval window (fenestra vestibuli) = attach stapes; Round window (fenestra cochlea) other end of cochlea

OTITIS MEDIA

1. Otitis Media – middle ear infection
- common in children
- middle ear is Dead End Cavity



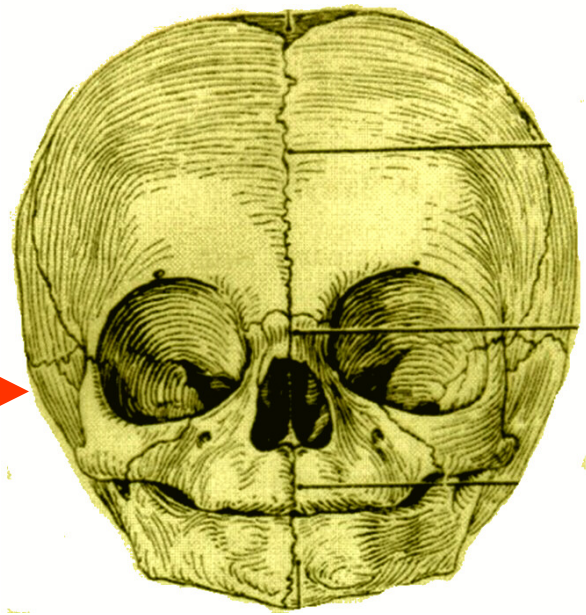
Tympanic Cavity is a Small space - In adult 15 mm. sup-inf, 15 mm. ant-post, 2-5 mm. med-lat

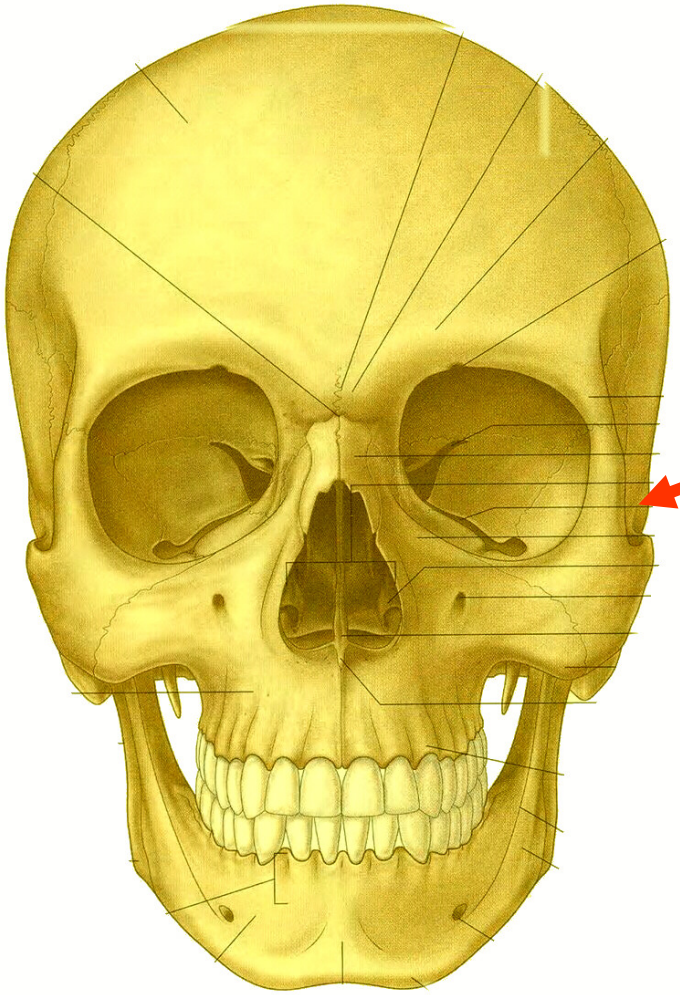
CLINICAL **

Spread of infection from Respiratory System can damage Auditory Ossicles - Hearing Loss; Prolonged infection - Tegmen Tympani to Brain; treatment tympanostomy - tube through tympanic membrane

OCCURRENCE OF OTITIS MEDIA DECLINES WITH AGE OF CHILD

orient of aud. tube





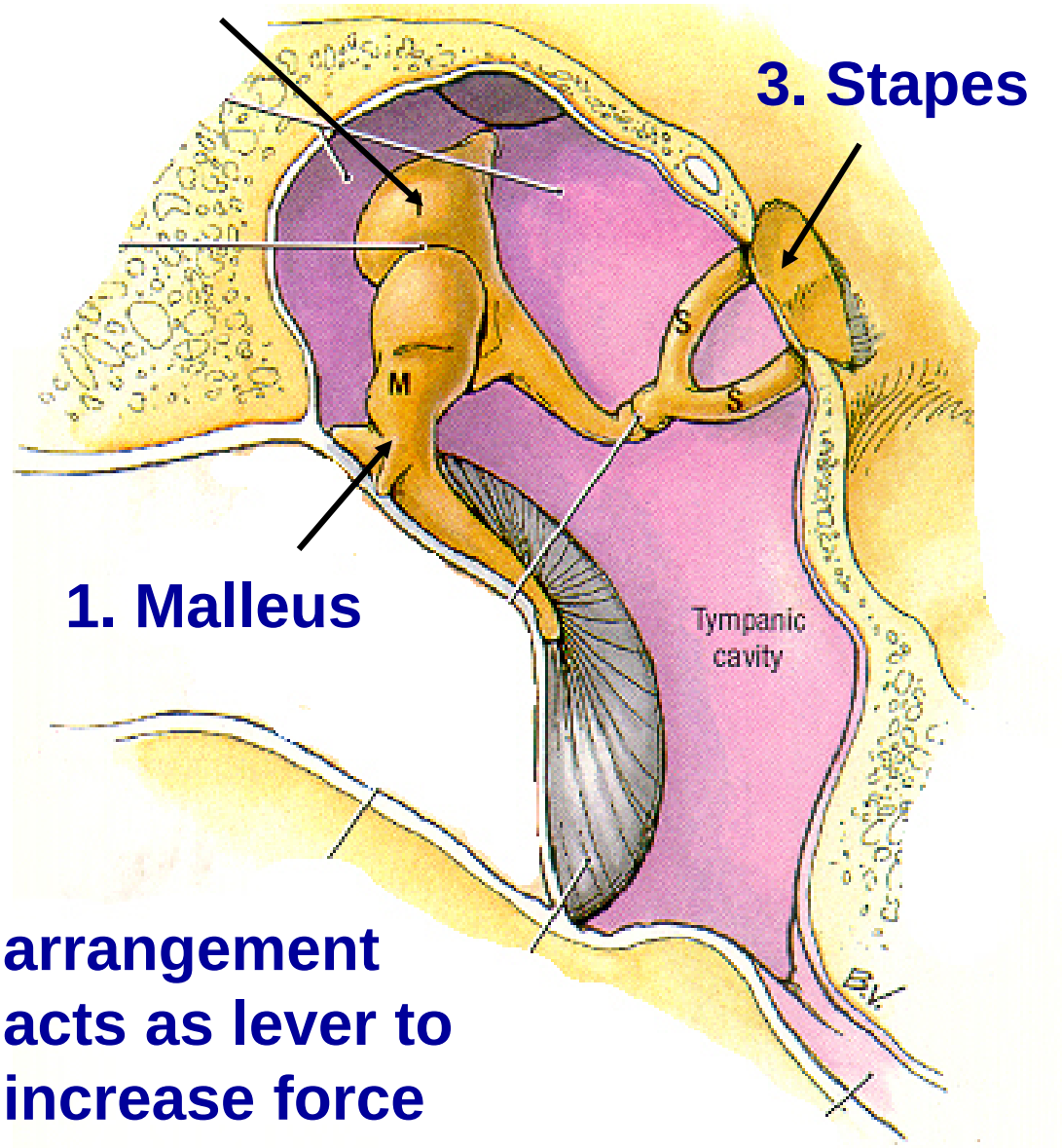
orient of aud. tube

ORIENTATION OF AUDITORY TUBE CHANGES FROM HORIZONTAL TO ANGLED WITH CRANIAL GROWTH (but contribution debated); diameter of lumen of auditory tube also increases

Last peak incidence of Otitis media at about 5 years of age

B. AUDITORY OSSICLES

2. Incus



arrangement acts as lever to increase force

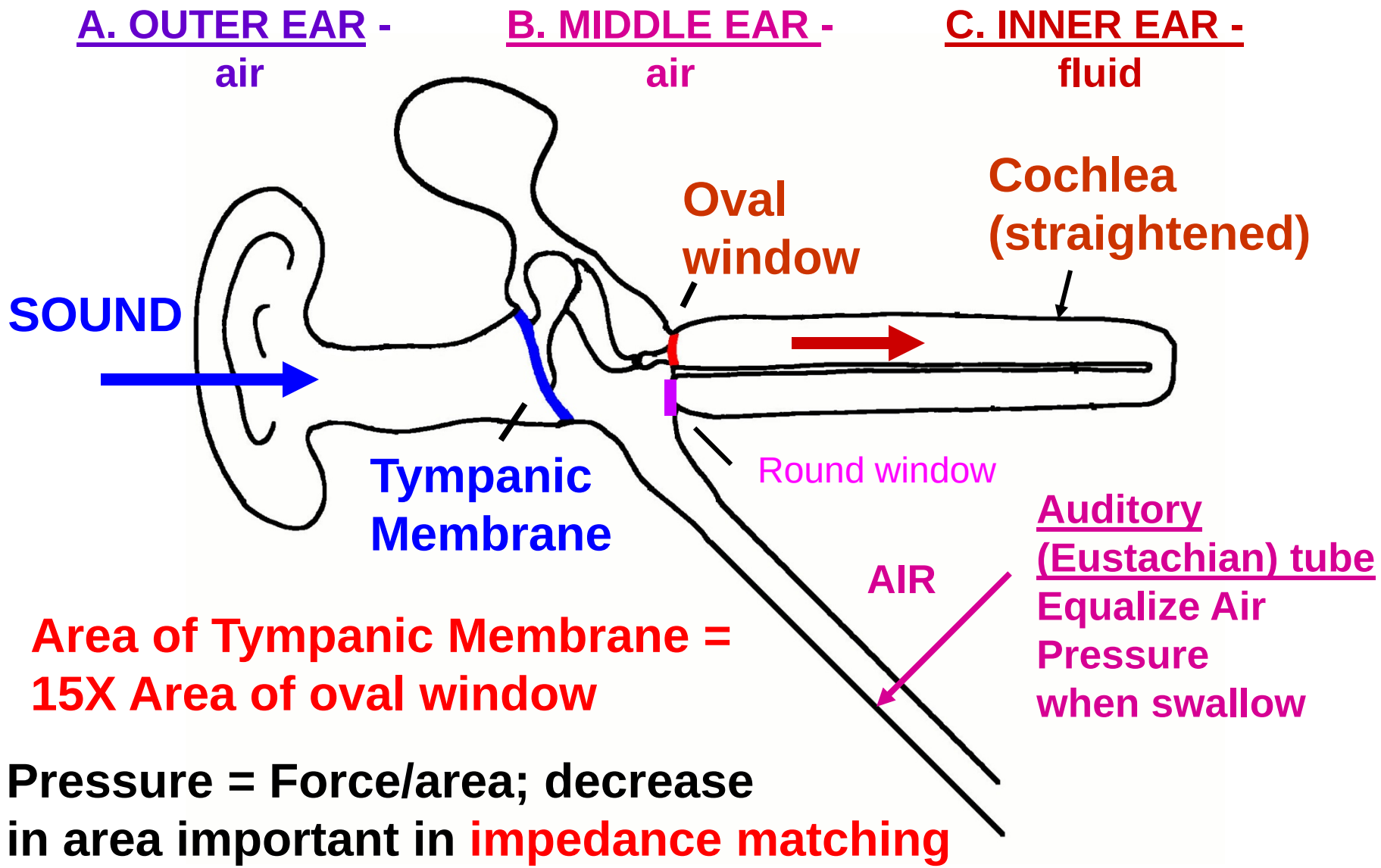
- link tympanic membrane to oval window and cochlea –

- anchored by ligaments

Malleus = hammer
Incus = anvil
Stapes = stirrup

- Broad attachment of Malleus to tympanic membrane

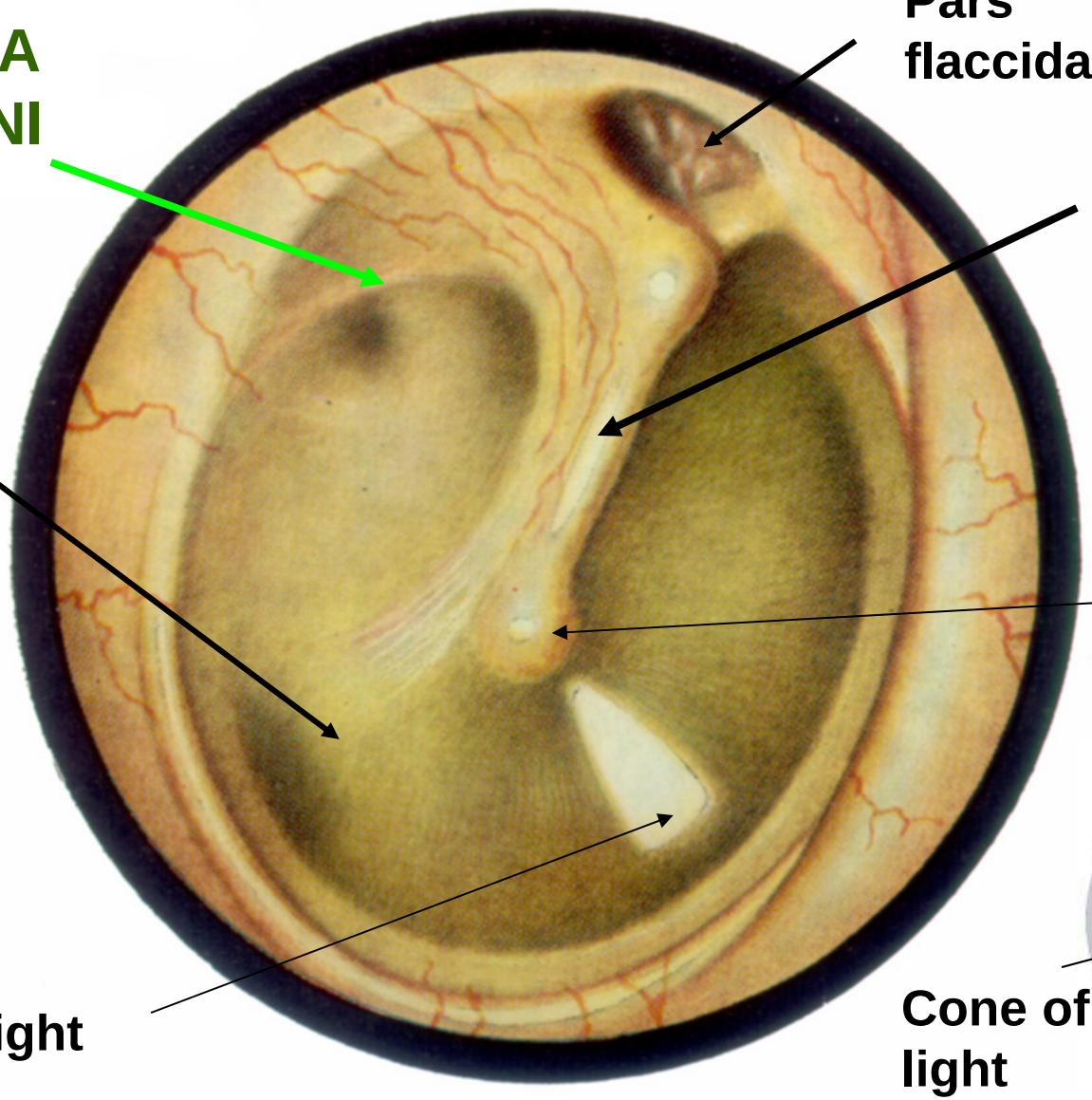
EAR: DIAGRAMMATICALLY - transmission of sound (Cochlea straightened)



Area of Tympanic Membrane = 15X Area of oval window

Pressure = Force/area; decrease in area important in impedance matching

OTOSCOPE VIEW OF TYMPANIC MEMBRANE



CHORDA TYMPANI (branch of VII)

Pars flaccida

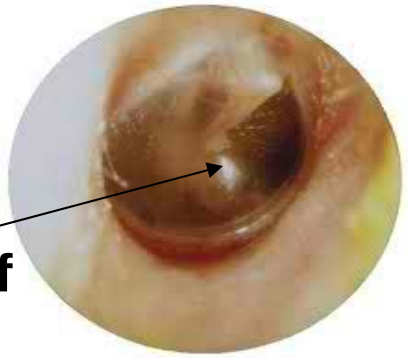
MALLEUS – manubrium (handle)

Pars tensa

Umbo (protuberance)

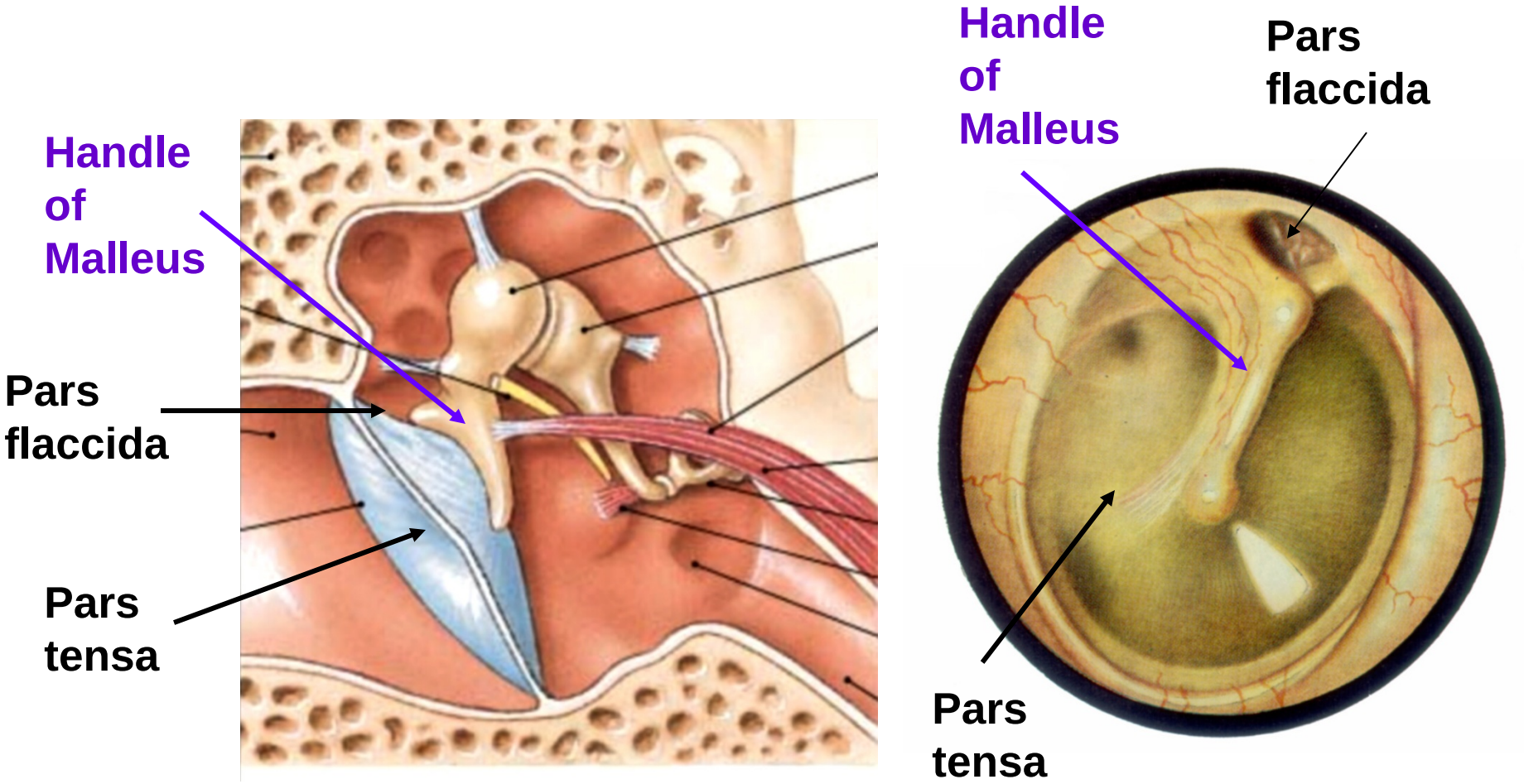
RIGHT EAR

Cone of light



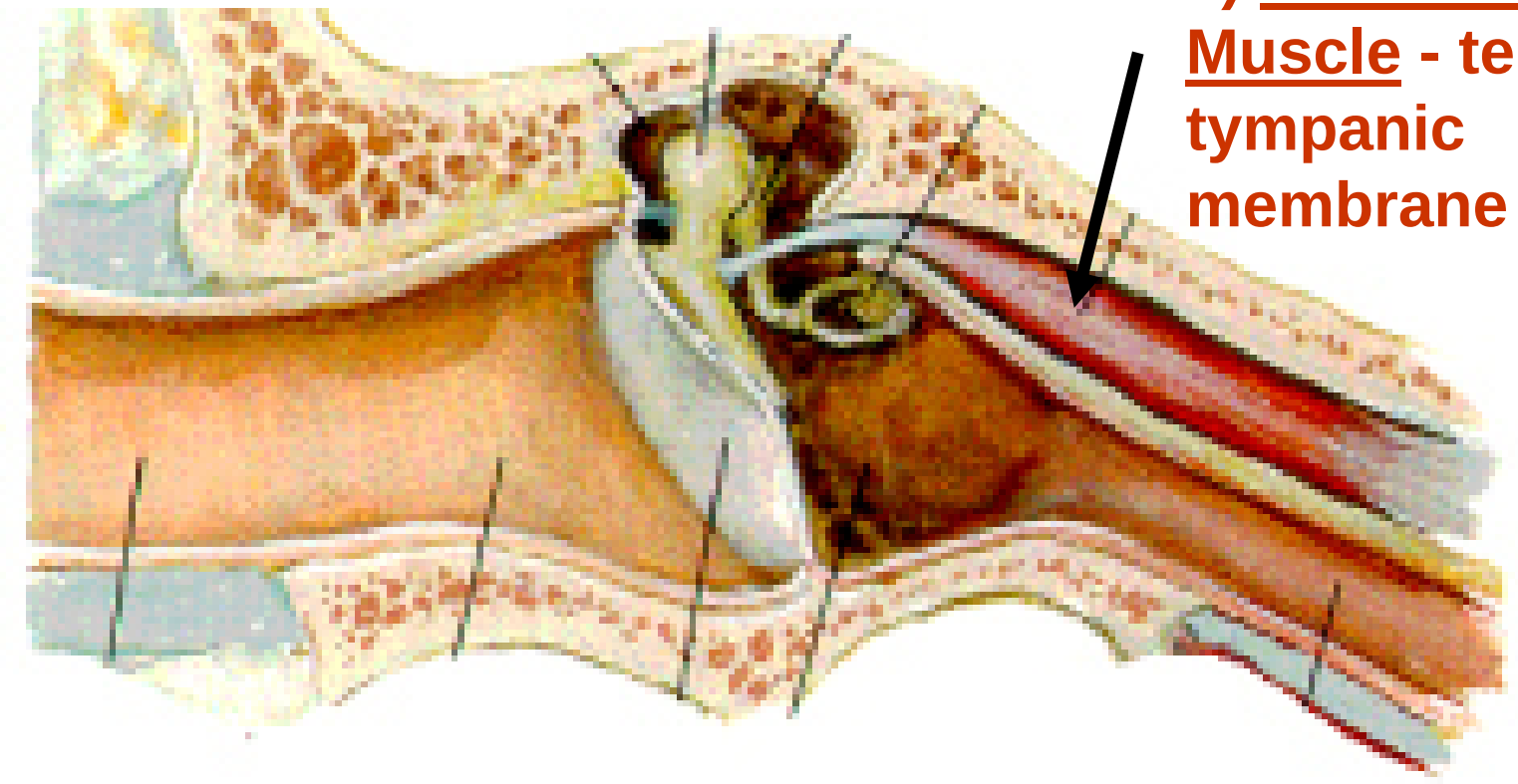
Cone of light

OTOSCOPE VIEW OF TYMPANIC MEMBRANE



Handle malleus is attached to upper half of Tympanic membrane; malleus is supported by ligaments linking it to wall of Tympanic cavity; part of Tympanic membrane surrounding handle is tense (pars tensa); upper end is less tense (pars flaccida)

MUSCLES OF MIDDLE EAR - dampen sound

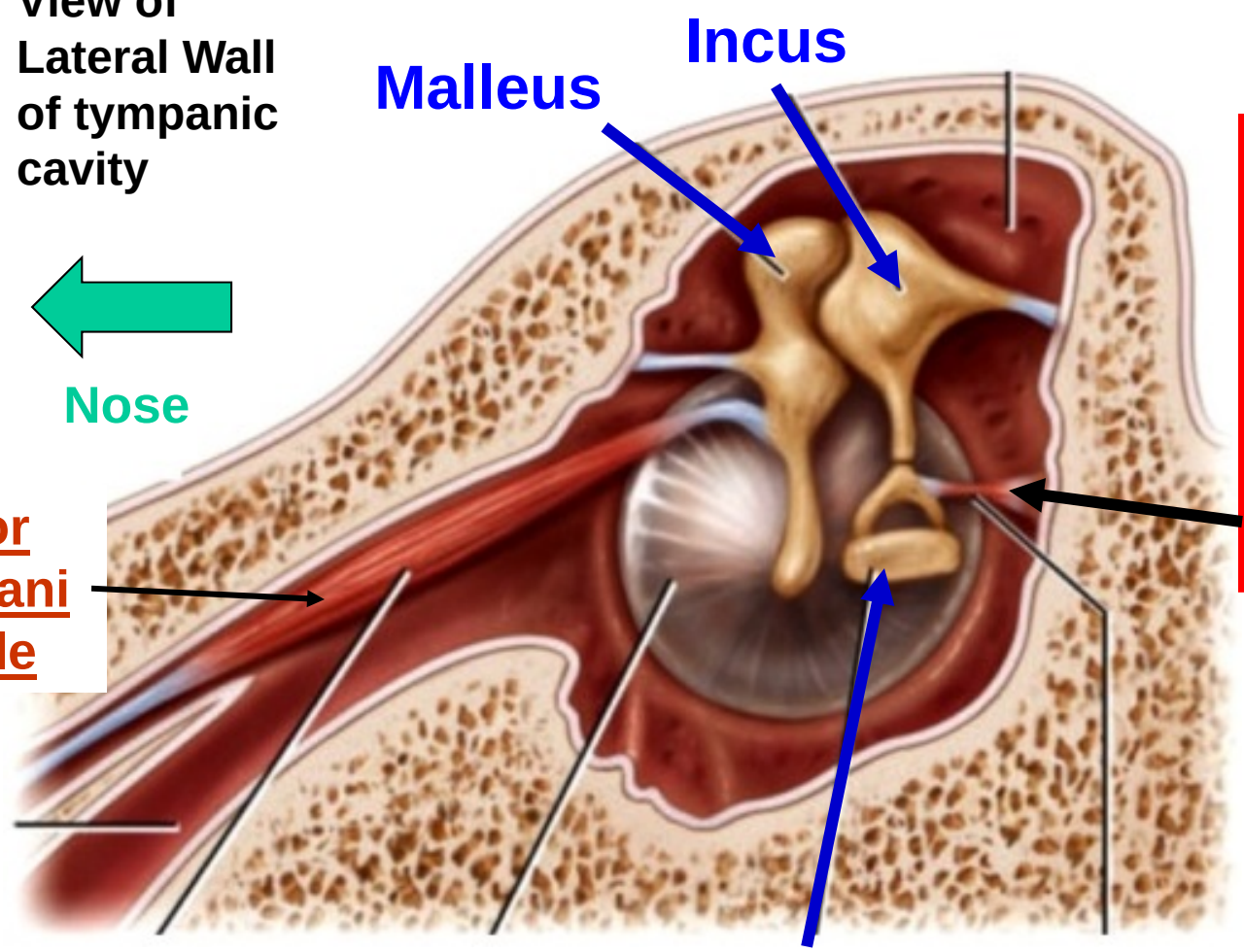


1) Tensor Tympani Muscle - tenses tympanic membrane

O - canal in ant. wall
I - handle of malleus
Inn - V3

C. MUSCLES OF MIDDLE EAR - dampen sound

View of Lateral Wall of tympanic cavity

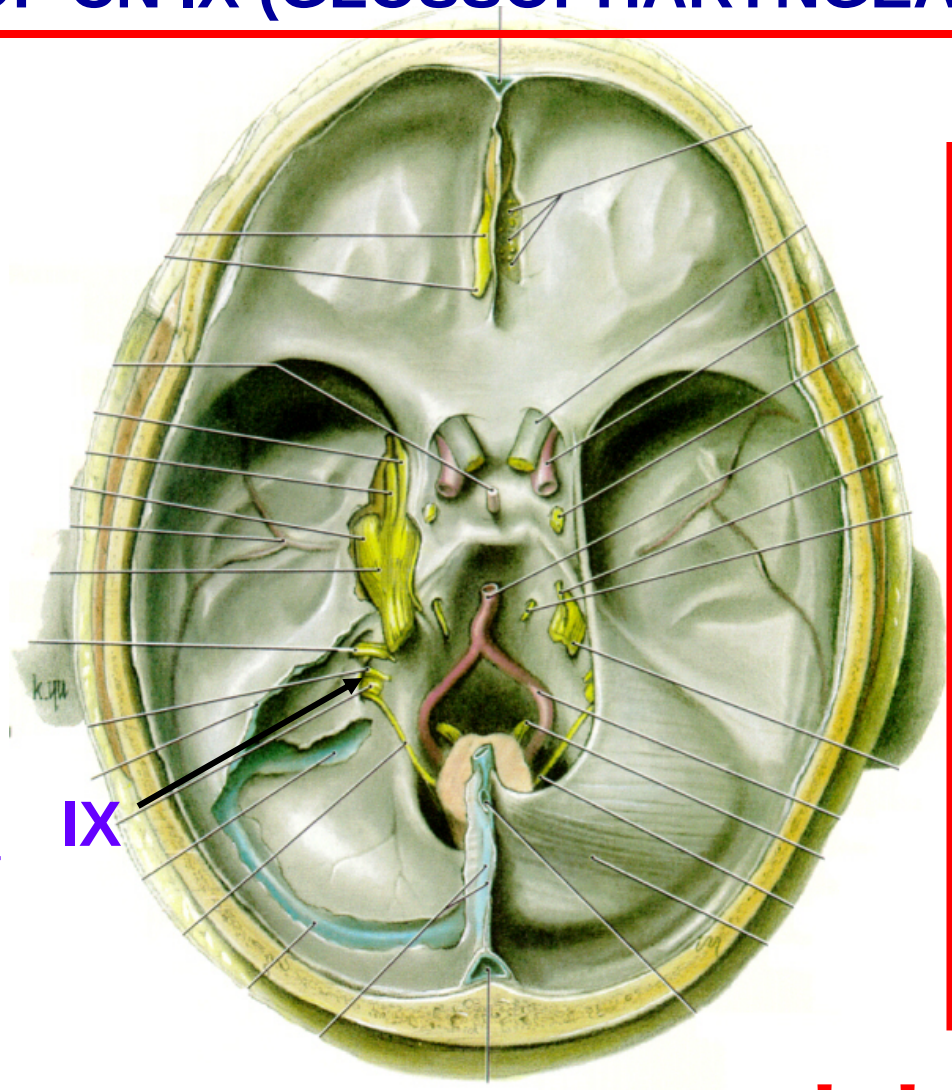


2) Stapedius
O - post wall (Pyramid)
I - neck of stapes
Inn - VII

CLINICAL **

Damage to VII - Hyperacousia - sounds seem too loud

D. SENSORY INNERVATION - VISCERAL SENSORY (GVA) FROM TYMPANIC PLEXUS OF CN IX (GLOSSOPHARYNGEAL)



leaves Posterlor Cranial Fossa via Jugular Foramen

CLINICAL ***

- Innervation of middle ear is visceral sensory from CN IX (Glossopharyngeal)

- Children with Middle Ear infections cannot localize pain - 'my head hurts'

**

BOARD QUESTION

IX - GLOSSOPHARYNGEAL

NOSE

exits via
Jugular Foramen

Lesser
Petrosal N.

Tympanic N.

Auditory
tube

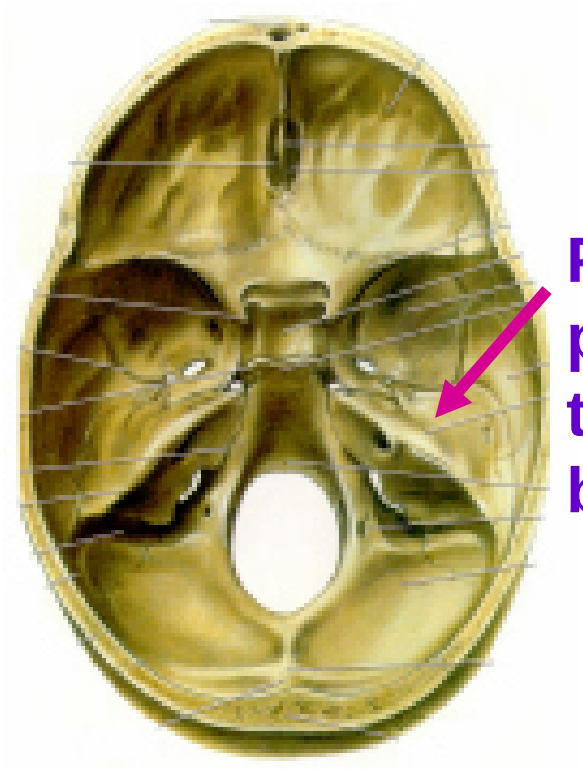
IX

exits via
Jugular Foramen

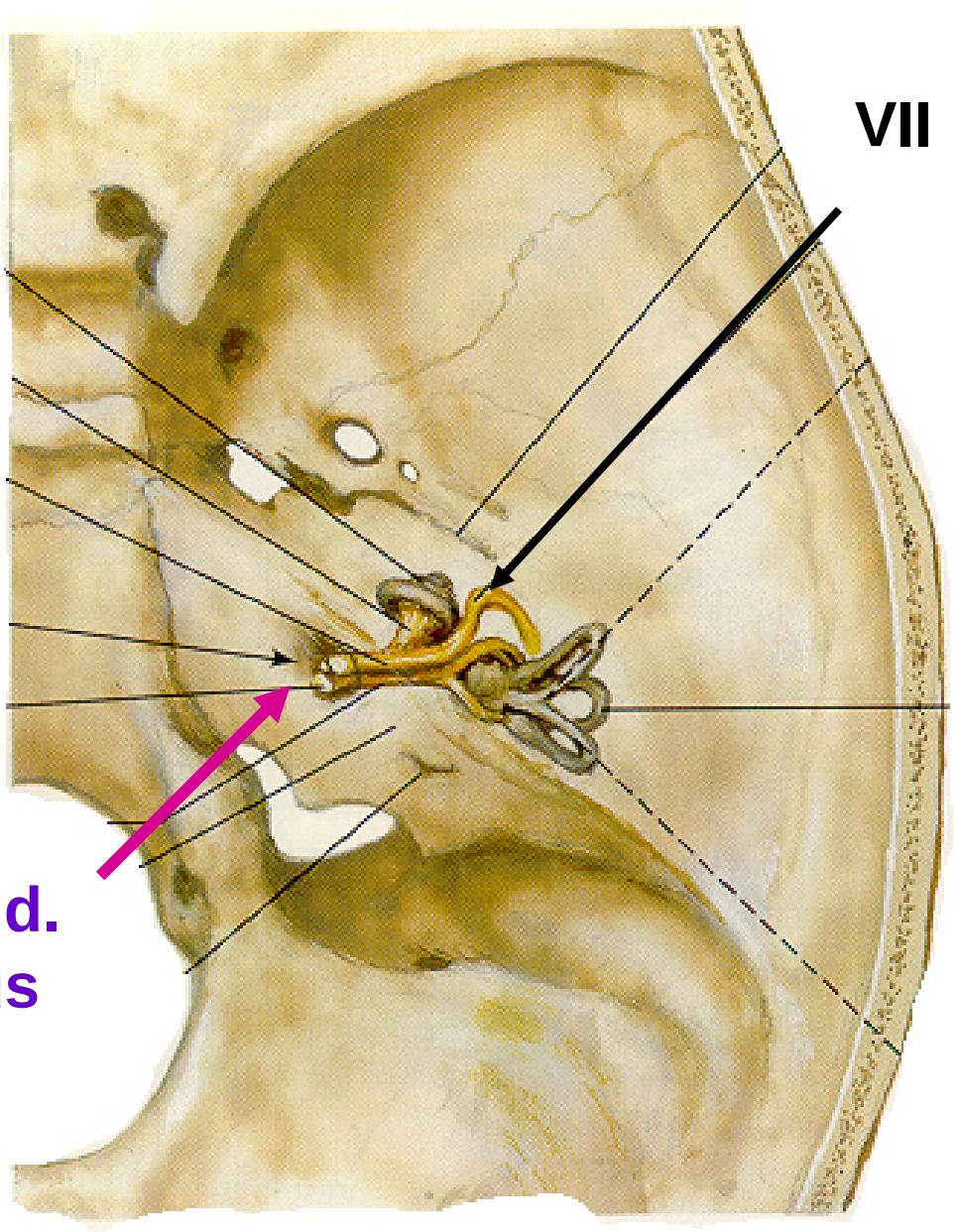
1. Tympanic Nerve
Forms tympanic plexus; VISCERAL SENSORY to middle ear
Mastoid sinus
auditory tube

2. Lesser Petrosal
VISCERAL MOTOR (parasymp)
To Parotid Gland

COURSE OF FACIAL NERVE (VII)



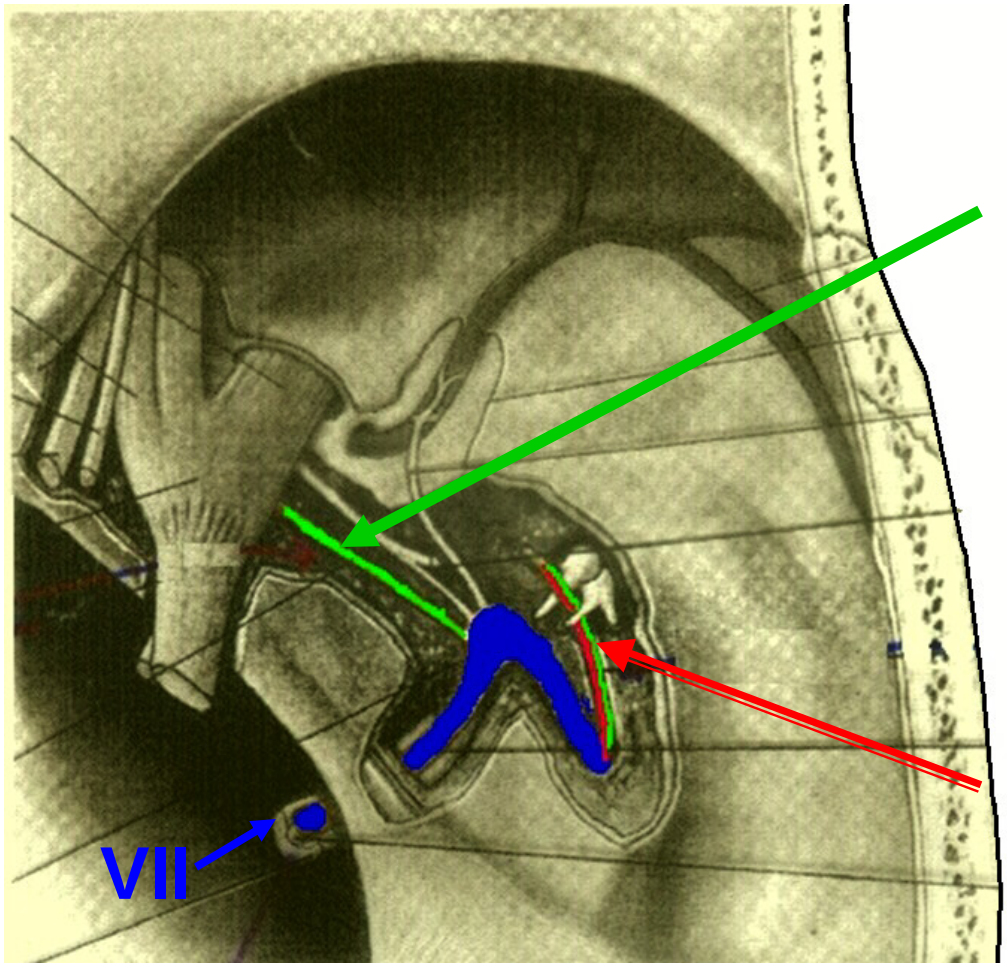
Petrous part of temporal bone



Int. aud. meatus

VII - FACIAL

leaves Posterior Cranial fossa via Internal Auditory Meatus - enters facial canal

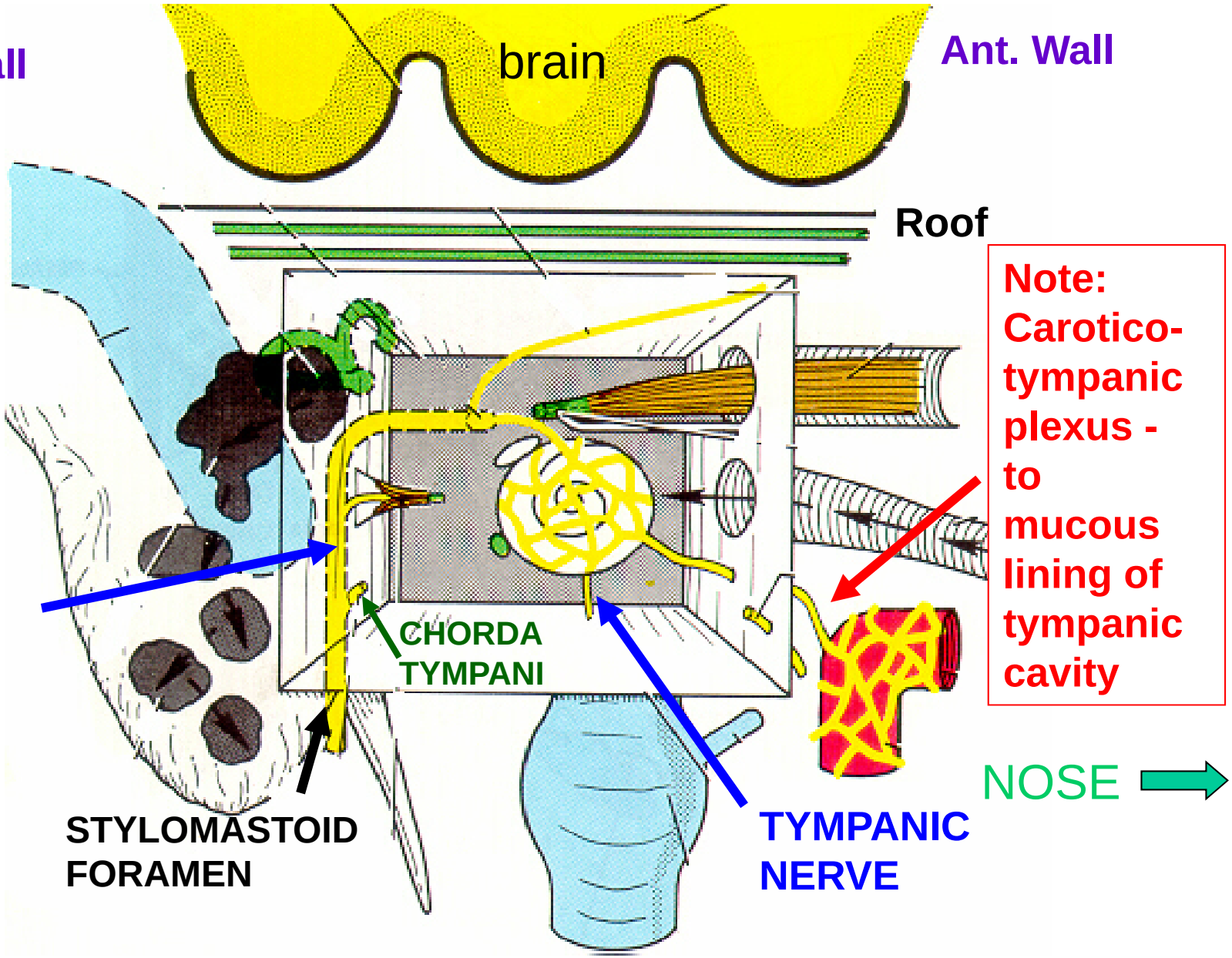


1. Greater Petrosal N.
VISCERAL MOTOR
Parasympathetics to Lacrimal gland, mucous glands of nose and palate, [Visceral sensory to Nasopharynx]

2. Stapedial N. - Branchiomotor to Stapedius

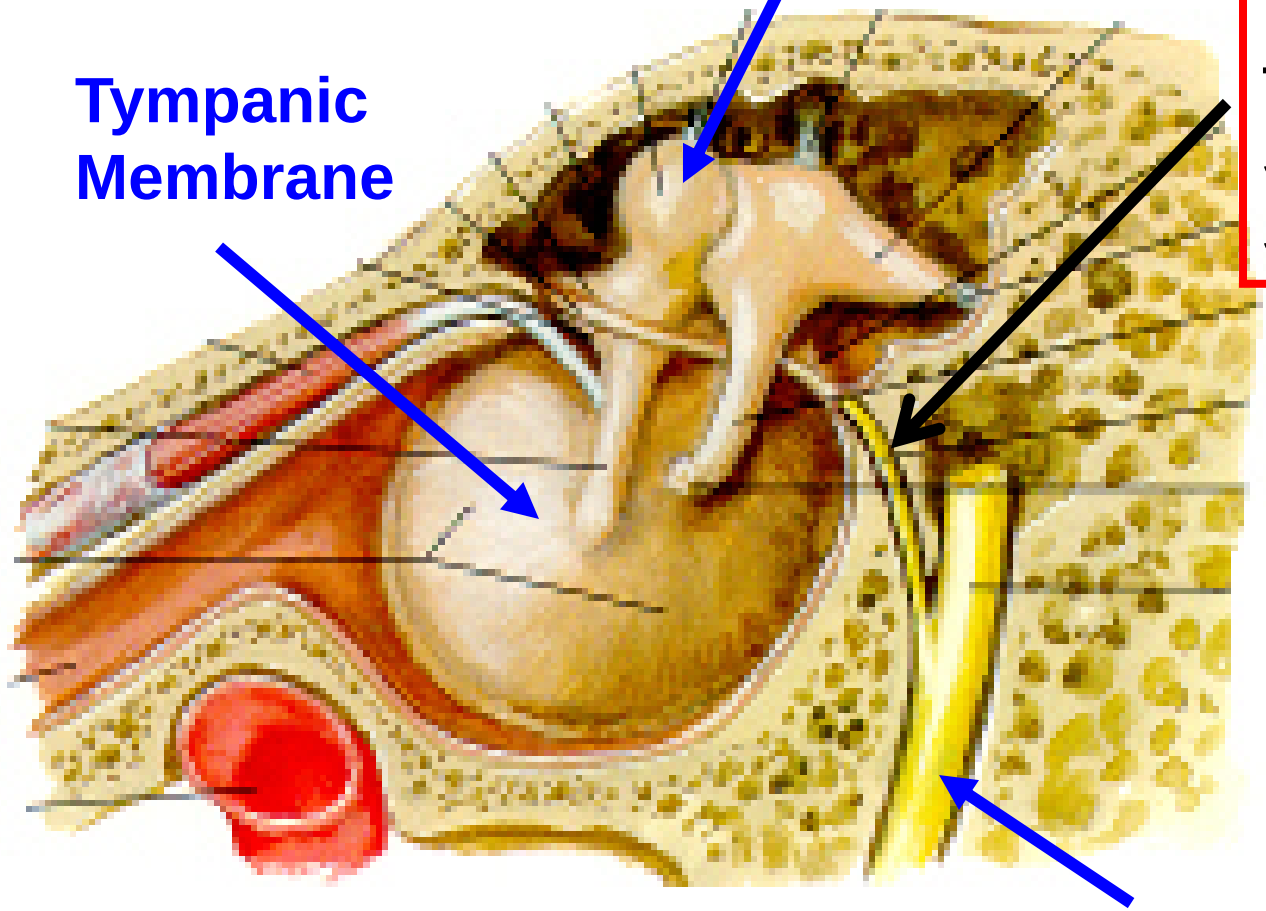
3. Chorda Tympani - has
A) Taste to ant 2/3 tongue
B) Parasympathetics to Submandibular, Sublingual salivary glands

LOCATION OF NERVES IN MIDDLE EAR



Looking at Medial Wall of Right Middle Ear with Ossicles Removed

CHORDA TYMPANI

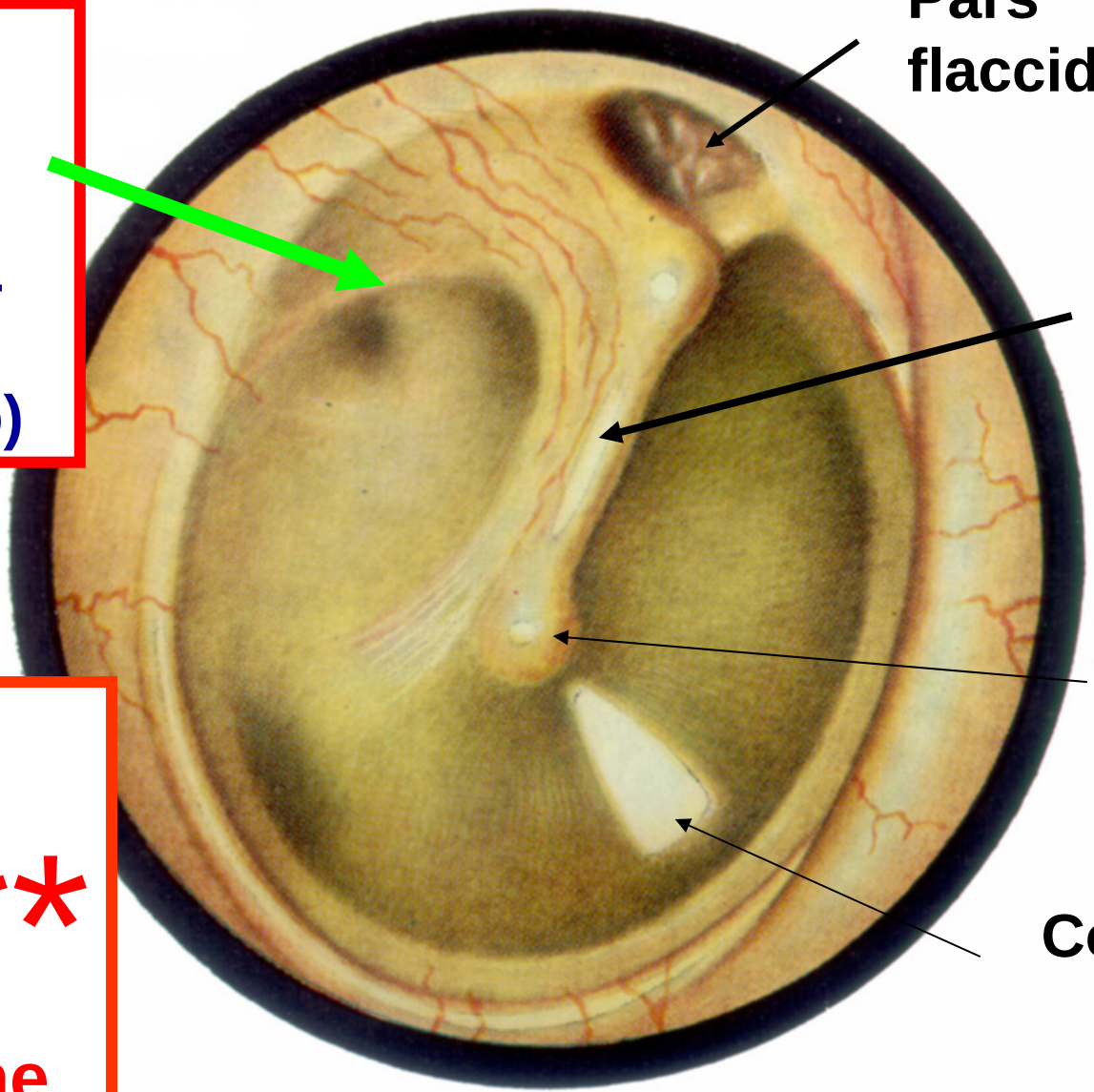


CLINICAL

Taste to ant. 2/3 of tongue
Parasympathetic to Submandibular, Sublingual Salivary glands

- Chorda Tympani has no function in middle ear
- Crosses through tympanic cavity
- Over handle of malleus

OTOSCOPE VIEW OF TYMPANIC MEMBRANE



CHORDA TYMPANI: TASTE, VISCERAL MOTOR (parasymp)

Pars flaccida

MALLEUS – manubrium (handle)

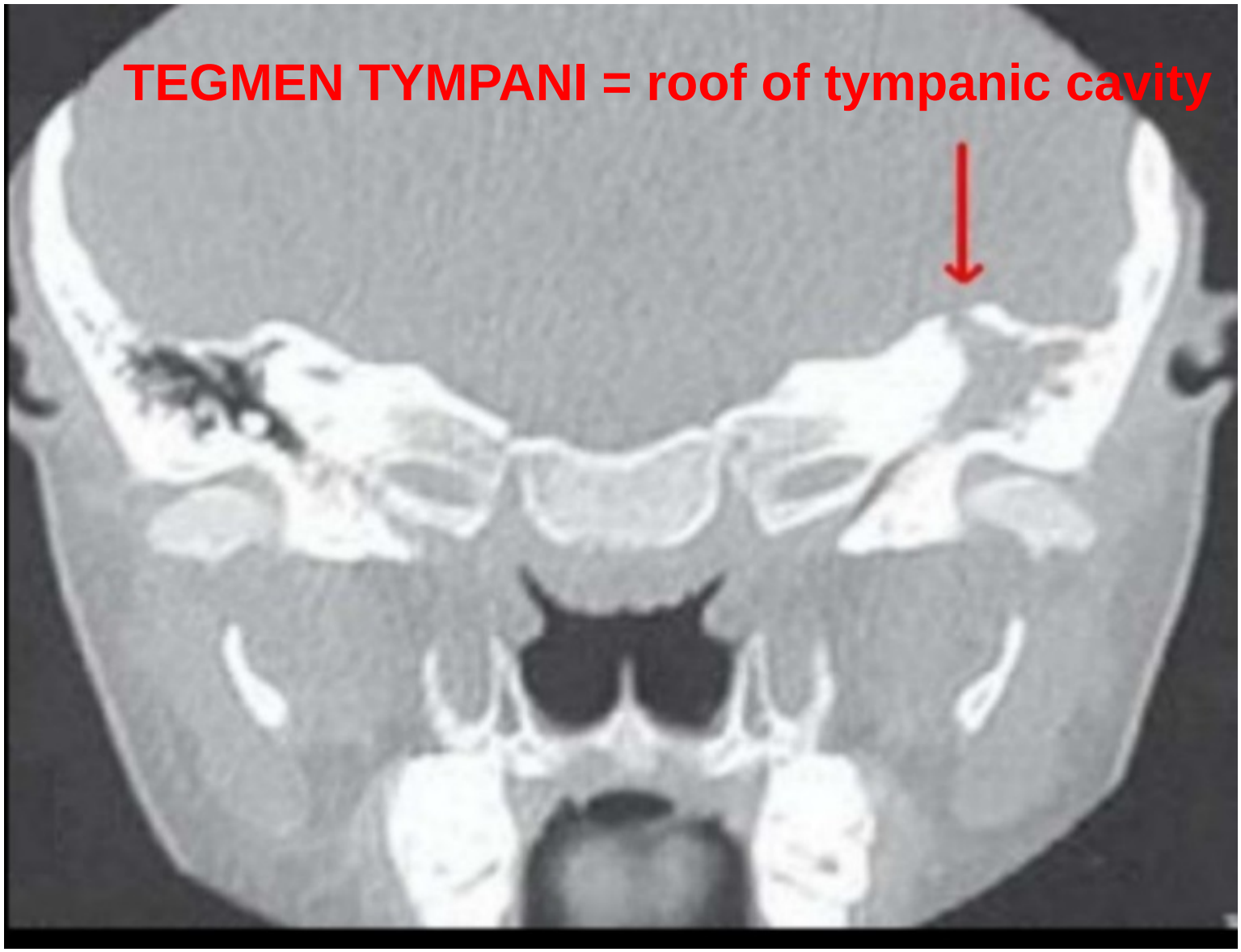
Umbo

Cone of light

CLINICAL*

Lose taste if pierce ** tympanic membrane

EROSION OF TEGMEN TYMPANI IN OTITIS MEDIA



tegman L. = covering